Miller®

October 1991 FORM: OM-141 438

MODEL: DUAL TORCH SYSTEM
Computer Interfaces
(per NSPR 9288)

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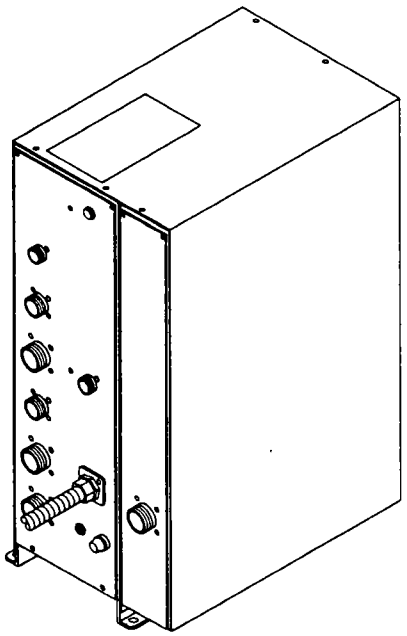

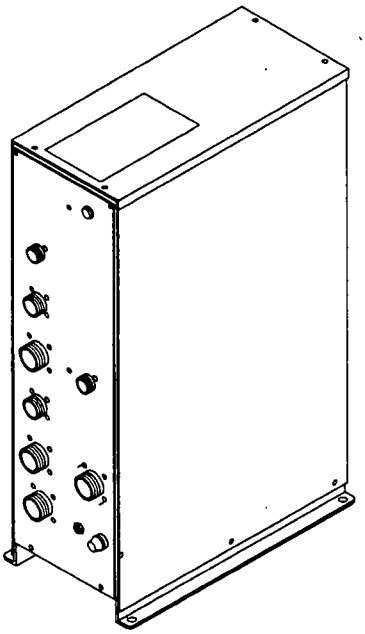

OWNER'S MANUAL

IMPORTANT: Read and understand the entire contents of both this manual and the power source manual used with this unit, with special emphasis on the safety material throughout both manuals, before installing, operating, or maintaining this equipment. This unit and these instructions are for use only by persons trained and experienced in the safe operation of robotic equipment. Do not allow untrained persons to install, operate, or maintain this unit. Contact your distributor if you do not fully understand these instructions.

MILLER ELECTRIC Mfg. Co.
A Miller Group Ltd., Company

P.O. Box 1079
Appleton, WI 54912 USA
Tel. 414-734-9821

LIMITED WARRANTY

EFFECTIVE: AUGUST 6, 1990

This warranty supersedes all previous MILLER warranties and is exclusive with no other guarantees or warranties expressed or implied.

LIMITED WARRANTY – Subject to the terms and conditions hereof, MILLER Electric Mfg. Co., Appleton, Wisconsin warrants to its Distributor/Dealer that all new and unused Equipment furnished by MILLER is free from defect in workmanship and material as of the time and place of delivery by MILLER. No warranty is made by MILLER with respect to engines, trade accessories or other items manufactured by others. Such engines, trade accessories and other items are sold subject to the warranties of their respective manufacturers, if any. All engines are warrantied by their manufacturer for two years from date of original purchase, except Deutz engines which have a one year, 2000 hour warranty.

Except as specified below, MILLER's warranty does not apply to components having normal useful life of less than one (1) year, such as spot welder tips, relay and contactor points, MILLERMATIC parts that come in contact with the welding wire including nozzles and nozzle insulators where failure does not result from defect in workmanship or material.

MILLER shall be required to honor warranty claims on warranted Equipment in the event of failure resulting from a defect within the following periods from the date of delivery of Equipment to the original user:

1. Arc welders, power sources, robots, and components ..... 1 year
2. Load banks ..... 1 year
3. Original main power rectifiers ..... 3 years (labor – 1 year only)
4. All welding guns, feeder/guns and torches .... 90 days
5. All other MILLERMATIC Feeders ..... 1 year
6. Replacement or repair parts, exclusive of labor 60 days
7. Batteries ..... 6 months

provided that MILLER is notified in writing within thirty (30) days of the date of such failure.

As a matter of general policy only, MILLER may honor claims submitted by the original user within the foregoing periods.

In the case of MILLER's breach of warranty or any other duty with respect to the quality of any goods, the exclusive remedies therefore shall be, at MILLER's option (1) repair or (2) replacement or, where authorized in writing by MILLER in appropriate cases, (3) the reasonable cost of repair or replacement at an authorized MILLER service station or (4) payment of or credit for the purchase price (less reasonable depreciation based upon actual use) upon return of the goods at Customer's risk and expense. MILLER's option of repair or replacement will be F.O.B., Factory at Appleton, Wisconsin, or F.O.B. at a MILLER authorized service facility, therefore, no compensation for transportation costs of any kind will be allowed. Upon receipt of notice of apparent defect or failure, MILLER shall instruct the claimant on the warranty claim procedures to be followed.

ANY EXPRESS WARRANTY NOT PROVIDED HEREIN AND ANY IMPLIED WARRANTY, GUARANTY OR REPRESENTATION AS TO PERFORMANCE, AND ANY REMEDY FOR BREACH OF CONTRACT WHICH, BUT FOR THIS PROVISION, MIGHT ARISE BY IMPLICATION, OPERATION OF LAW, CUSTOM OF TRADE OR COURSE OF DEALING, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR PARTICULAR PURPOSE, WITH RESPECT TO ANY AND ALL EQUIPMENT FURNISHED BY MILLER IS EXCLUDED AND DISCLAIMED BY MILLER.

EXCEPT AS EXPRESSLY PROVIDED BY MILLER IN WRITING, MILLER PRODUCTS ARE INTENDED FOR ULTIMATE PURCHASE BY COMMERCIAL/INDUSTRIAL USERS AND FOR OPERATION BY PERSONS TRAINED AND EXPERIENCED IN THE USE AND MAINTENANCE OF WELDING EQUIPMENT AND *NOT* FOR CONSUMERS OR CONSUMER USE. MILLER'S WARRANTIES DO NOT EXTEND TO, AND NO RESELLER IS AUTHORIZED TO EXTEND MILLER'S WARRANTIES TO, ANY CONSUMER.

RECEIVING-HANDLING

Before unpacking equipment, check carton for any damage that may have occurred during shipment. File any claims for loss or damage **with the delivering carrier**. Assistance for filing or settling claims may be obtained from the distributor and/or the equipment manufacturer's Transportation Department.

When requesting information about this equipment, always provide the Model Description and Serial or Style Number.

Use the following spaces to record the Model Designation and Serial or Style Number of your unit. The information is located on the rating label or the nameplate.

Model _____

Serial or Style No. _____

Date of Purchase _____

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SECTION 1 – SAFETY PRECAUTIONS AND SIGNAL WORDS

1-1. GENERAL INFORMATION AND SAFETY

A. General

Information presented in this manual and on various labels, tags, and plates on the unit pertains to equipment design, installation, operation, maintenance, and troubleshooting which should be read, understood, and followed for the safe and effective use of this equipment.

B. Safety

The installation, operation, maintenance, and troubleshooting of arc welding equipment requires practices and procedures which ensure personal safety and the safety of others. Therefore, this equipment is to be installed, operated, and maintained only by qualified persons in accordance with this manual and all applicable codes such as, but not limited to, those listed at the end of Section 1 – Safety Rules For Operation Of Arc Welding Power Source in the welding power source Owner's Manual.

1-2. SAFETY ALERT SYMBOL AND SIGNAL WORDS

The following safety alert symbol and signal words are used throughout this manual to call attention to and identify different levels of hazard and special instructions.

This safety alert symbol is used with the signal words WARNING and CAUTION to call attention to the safety statements.

WARNING statements identify procedures or practices which must be followed to avoid serious personal injury or loss of life.

CAUTION statements identify procedures or practices which must be followed to avoid minor personal injury or damage to this equipment.

IMPORTANT *statements identify special instructions necessary for the most efficient operation of this equipment.*

SECTION 2 – INTRODUCTION

2-1. DESCRIPTION

The dual torch system allows use of two welding guns/torches that connect to two separate welding power sources for simultaneous welding by a single robot. The system provides wire feed speed and voltage control circuitry, wire stick check circuitry, and other circuitry to interface a second welding system with the Robot Control.

A second Display Module for the additional welding system provides display of wire feed speed, voltage, and peak amperage. Peak amperage and arc inductance can be set at both Display Modules. Indicator lights include power, gas, contactor, wire feed, and WCR (weld current relay). A second WCR Box is supplied for use with the additional welding system.

The design application of the dual torch system is for use in the Gas Metal Arc Welding (GMAW) process.

SECTION 3 – INSTALLATION

3-1. LOCATION

The location of the Dual Torch System Computer Interface should allow room to remove cover and side panels for maintenance and repair.

Mounting holes are provided in the Dual Torch System Computer Interface base for securing in a permanent location. Install the Dual Torch System Computer Interface near the welding power source. The supplied Display Module installs onto the module stand. The supplied WCR box should be installed in a location that will allow the weld cable from a welding power source to be easily routed through the box and to the second wire drive assembly. Cord and cable lengths must be considered when installing components for the dual torch system.

The location should also provide the following:

1. Adequate ventilation and fresh air supply
2. No flammables
3. A clean and dry area
4. Proper temperature that avoids extremes of hot or cold
5. Proper airflow around the unit.

3-2. WIRE STICK CHECK OPTIONS (Figure 3-1)

The Computer Interface is equipped with two DIP switches found on the Interface circuit board PC4. These switches are factory set to provide no voltage ramp during wire stick check. If either of these selections need to be changed for a particular welding application, proceed as follows:

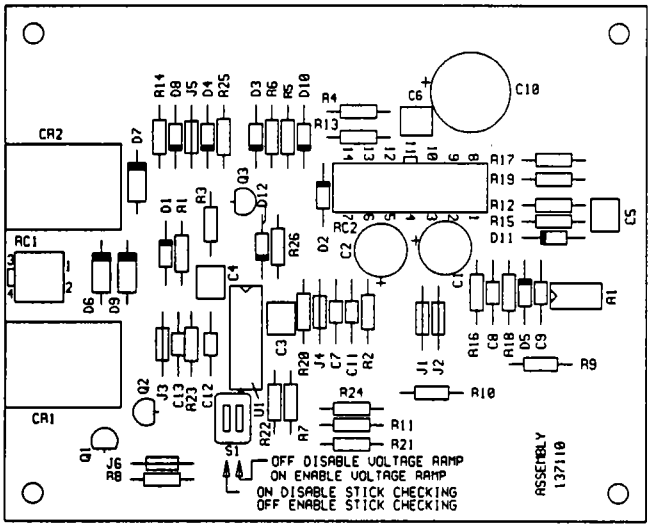

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Figure 3-1. DIP Switch Location And Information

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lock-out/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of pad-locking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Remove Computer Interface left side panel.
2. Locate DIP switches on Interface circuit board PC4 (see Figure 3-1).
3. Reposition appropriate DIP switch using a pointed tool, such as the edge of a small screwdriver.
4. Reinstall left side panel.

3-3. FIELD INSTALLATION INSTRUCTIONS FOR COMPUTER INTERFACE DUAL TORCH ADAPTER PANEL

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lock-out/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of pad-locking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

CAUTION: ELECTROSTATIC DISCHARGE (ESD) can damage circuit boards.

- *Put on properly grounded wrist strap BEFORE handling circuit boards.*
- *Transport circuit boards in proper static-shielding carriers or packages.*
- *Perform work only at a static-safe work area.*

INCORRECT INSTALLATION or misaligned plugs can damage circuit board.

- *Be sure that plugs are properly installed and aligned.*

EXCESSIVE PRESSURE can break circuit board.

- *Use only minimal pressure and gentle movement when disconnecting or connecting board plugs and removing or installing board.*

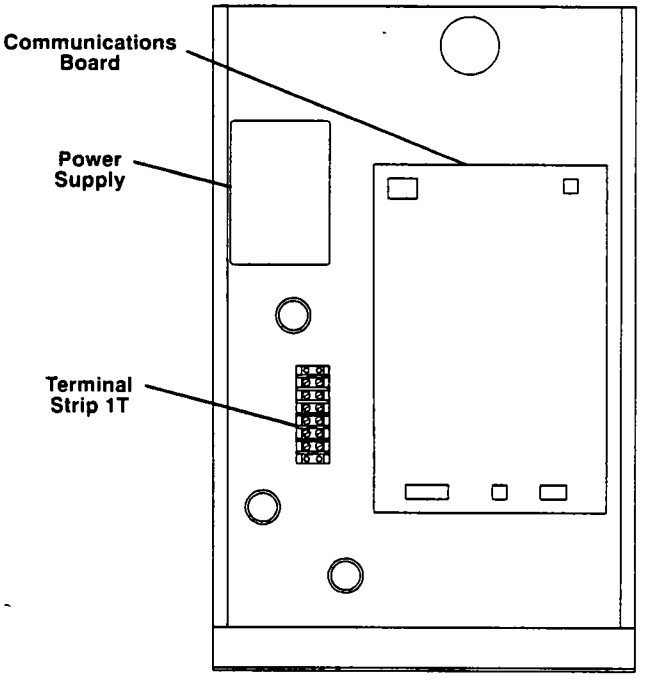

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Figure 3-2. Right Side View Of Original Computer Interface Components

1. Remove original Computer Interface top cover and both side panels.

2. Mark and disconnect connectors from Communication board (see Figure 3-2).

3. Remove Communication board from center baffle inside Computer Interface.

4. Install supplied dual adapter board to lower four nylon snap-in standoffs on center baffle.

5. Reconnect connectors removed in Step 2 to matching locations on dual adapter board. Physical location of connectors is the same on dual adapter board as on the Communication board (see Figure 3-5). Connect plug on end of supplied wiring harness to matching receptacle on dual adapter board.

6. Install Dual Torch Adapter frame onto right side of Computer Interface with sheet metal screws.

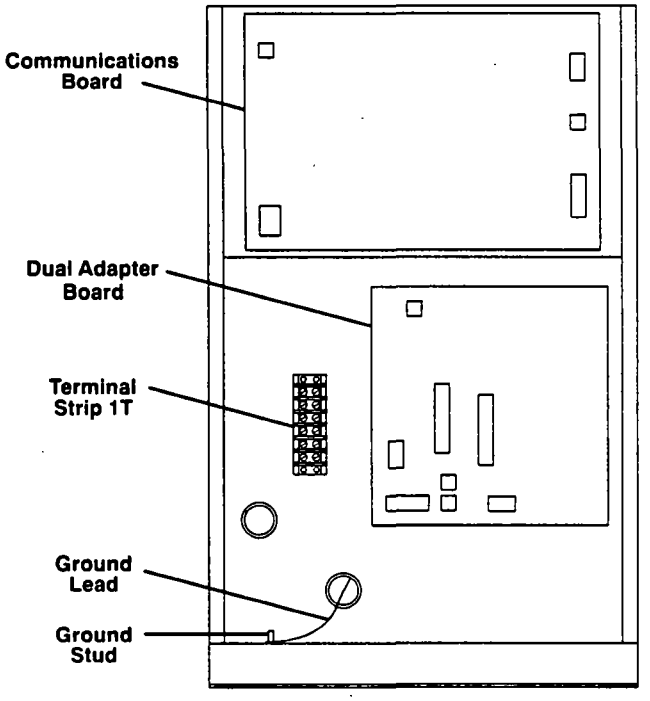

Figure 3-3. Right Side View Of Computer Interface Components After Adding Frame

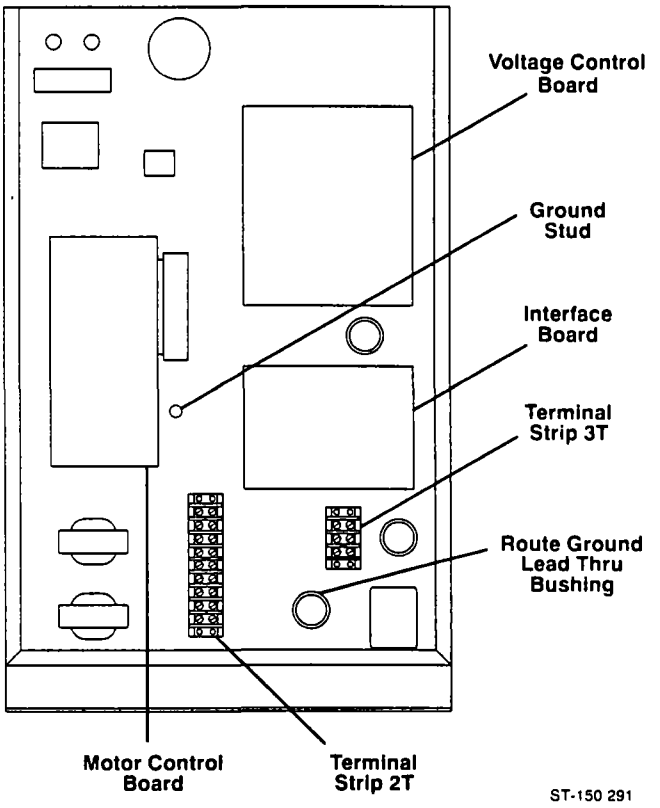

Figure 3-4. Ground Lead Connection On Left Side Of Computer Interface

7. Reinstall Communication board onto center baffle of frame (see Figure 3-3). Fiber optic link connector on board must point toward front of frame. Reconnect fiber optic wave guide to fiber optic link connector on board.

8. Connect connectors from dual adapter board and dual adapter frame receptacle RC 19 to matching locations on Communication board. Connector from receptacle RC19 installs to receptacle RC 2 on dual adapter board. Connectors from dual adapter wiring harness install to matching connectors on Communication board (see Figure 3-3).

9. Route green ground lead from stud on Dual Torch Adapter frame through bushing in center baffle, and connect ring terminal on end of lead to ground stud on center baffle (see Figures 3-3 and 3-4).

10. Install supplied right side panel onto dual adapter frame. Original right side panel can be retained or discarded.

11. Reinstall left side panel, and install supplied top cover onto unit.

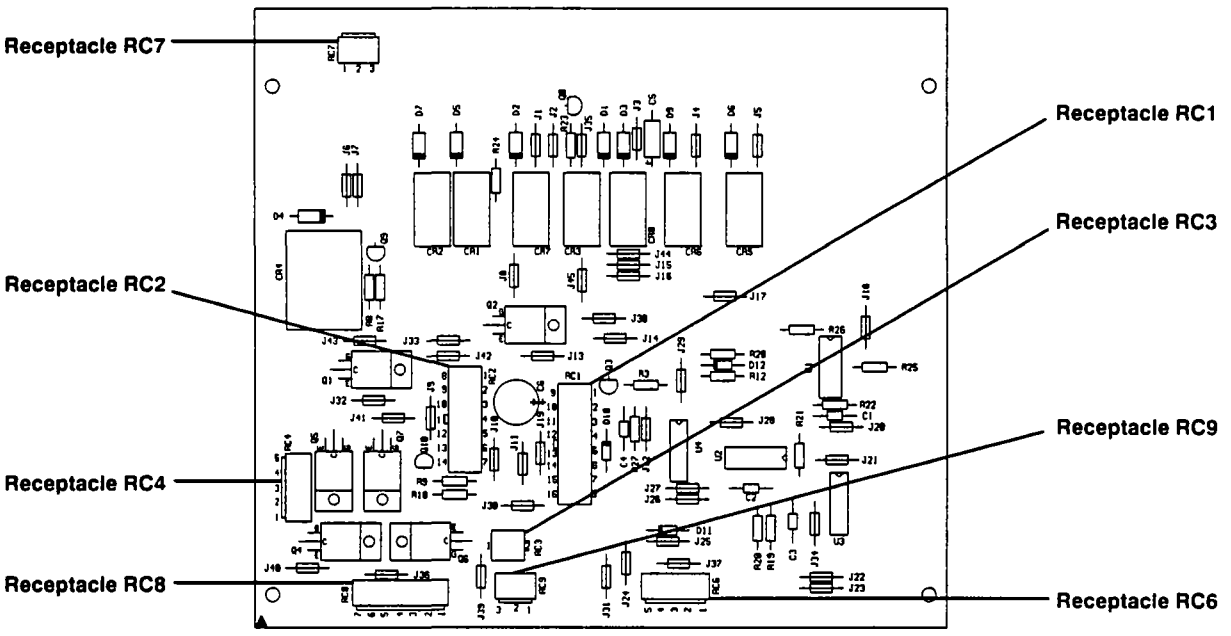

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Figure 3-5. Connectors On Dual Adapter Board PC7

3-4. FIELD INSTALLATION INSTRUCTIONS FOR SECOND WIRE DRIVE ASSEMBLY

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Remove spindle and hub assembly from spool support arm.
2. Use a 3/8 in. (10 mm) drill bit and drill lower hole through brace plate on inside of spool support arm channel using existing hole in channel as a guide.
3. Install motor/drive assembly mounting bracket using the two holes in the spool support arm and top rear hole in original motor/drive assembly mounting bracket (see Figure 3-6).
4. Install Gas/Motor Control box to rear of supplied motor/drive assembly bracket (see Figure 3-6).

IMPORTANT: *Install insulating strip between motor/drive assembly mounting bracket and motor/drive assembly housing. Housing installs to outside front surface of bracket with insulating strip between metal surfaces.*

5. Install motor/drive assembly to mounting bracket. Use insulated shoulder washers on bolts to secure motor/drive assembly to bracket.
6. Connect plug on end of motor cord to receptacle on Gas/Motor Control box.

3-5. FIELD INSTALLATION INSTRUCTIONS FOR WELDING GUNS ON ROBOT

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Remove original welding gun from insulating plate on Axis 5 output hub.
2. Install customer-supplied dual torch mounting bracket.
3. Reinstall original welding gun onto dual torch mounting bracket.
4. Install supplied welding gun onto dual torch mounting bracket.
5. Install supplied outlet cable to supplied motor/drive assembly housing (see motor/drive assembly Owner's Manual).
6. Install remaining end of outlet cable to supplied welding gun (see welding gun Owner's Manual).
7. Use cable ties to secure supplied outlet cable to original outlet cable.

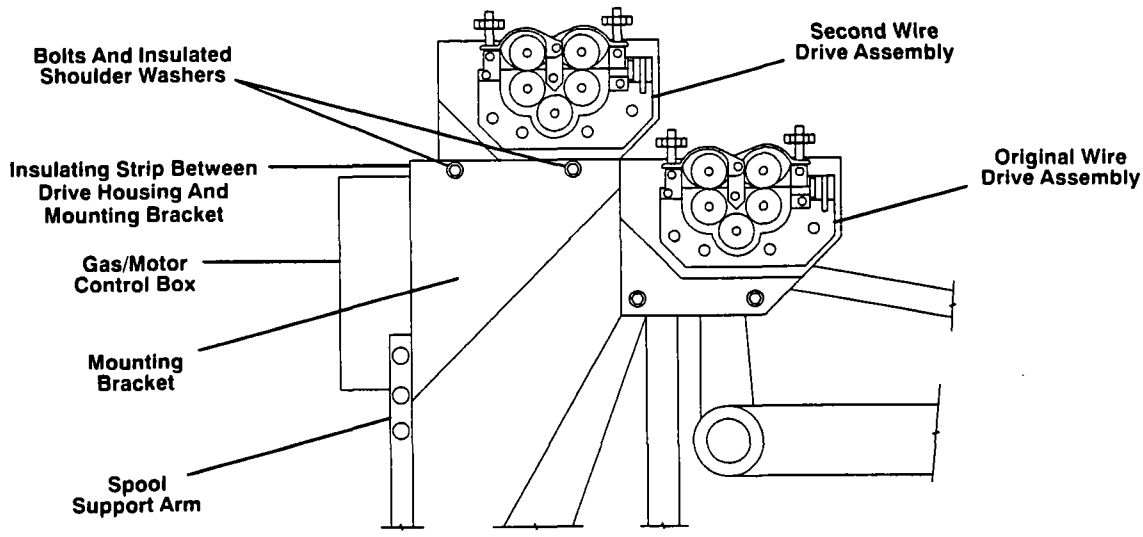


Figure 3-6. Installation Of Second Wire Drive Assembly

3-6. FIELD INSTALLATION INSTRUCTIONS FOR CONNECTING TOUCH SENSOR LEADS

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lock-out/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of pad-locking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

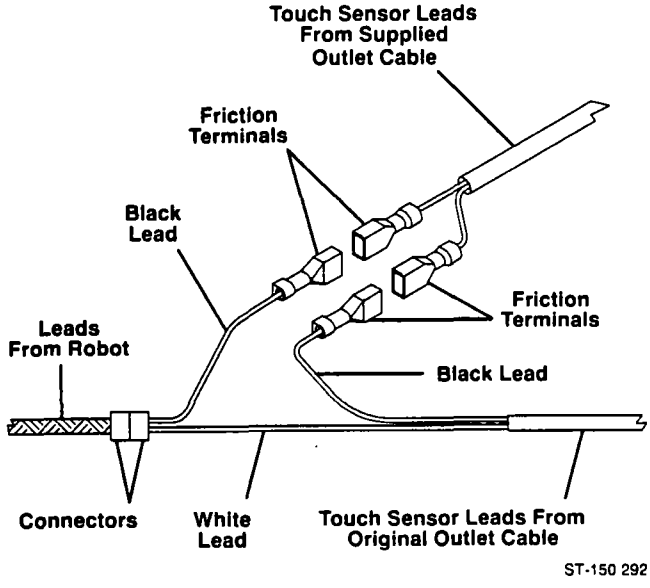


Figure 3-7. Connection Of Touch Sensor Leads

1. Cut black touch sensor lead approximately 1 in. (25 mm) above plug on original outlet cable (see Figure 3-7).
2. Strip insulation back 1/4 in. (6 mm) at both ends of black lead.
3. Install supplied male friction terminals onto ends of black leads.
4. Remove plug from supplied outlet cable by cutting leads as close to plug housing as possible.
5. Strip insulation back 1/4 in. (6 mm) at end of both leads.
6. Install supplied female friction terminals onto end of both leads.
7. Connect friction terminals on touch sensor leads of supplied outlet cable to friction terminals installed in Step 3 (see Figure 3-7).

3-7. FIELD INSTALLATION INSTRUCTIONS FOR SUPPLIED DISPLAY MODULE

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lock-out/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of pad-locking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Disassemble supplied Display Module from mounting plate (see Figure 3-8).
2. Remove original Display Module from module stand.
3. Install original Display Module onto rear of mounting plate for supplied Display Module using existing holes (see Figure 3-8).
4. Reassemble supplied Display Module onto mounting plate.
5. Install mounting plate onto module stand.

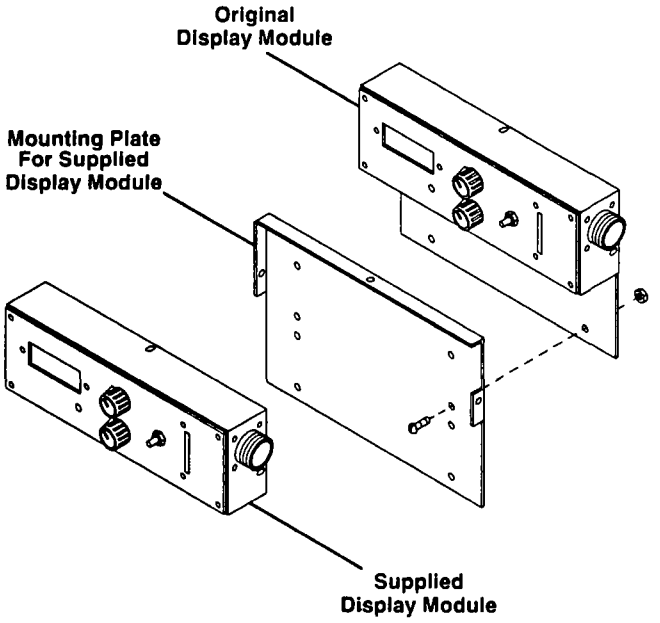


Figure 3-8. Installation Of Supplied Display Module

3-8. CONNECTIONS FOR COMPUTER INTERFACES (Figure 3-9)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting or installing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

1. Connect matching plug on end of supplied interconnecting cord to receptacle RC19 on Computer Interface Dual Torch Adapter panel.
2. Connect plug on remaining end of interconnecting cord to receptacle RC20 on Dual Torch Computer Interface.
3. Connect matching plug on end of supplied motor cord to receptacle RC9 on Dual Torch Computer Interface.
4. Connect plug on remaining end of motor cord to receptacle on Gas/Motor Control box.
5. Connect plug on end of supplied WCR box to receptacle RC8 on Dual Torch Computer Interface.

IMPORTANT: *Be sure that weld cable from positive weld output terminal on welding power source is routed through opening in WCR box before connecting to motor/drive assembly.*

6. Connect weld cable from positive weld output terminal on welding power source to stud on motor/drive assembly housing (see motor/drive assembly Owner's Manual).
7. Connect weld cable from negative weld output terminal on welding power source to workpiece or fixture.
8. Connect plug on end of voltage sensing leads to receptacle RC14 on Dual Torch Computer Interface.

IMPORTANT: *Voltage sensing lead ring terminal must be installed on top of weld cable lug at motor/drive assembly.*

9. One lead with ring terminal should be connected to supplied motor/drive assembly where weld cable from welding power source is connected.
10. Connect remaining lead to the workpiece or fixture near weld cable connection from welding power source.
11. Connect matching plug on supplied cord to receptacle RC12 on Dual Torch Computer Interface.
12. Connect plug on remaining end of cord to bottom Display Module on module stand.
13. Connect fitting on end of supplied short gas hose to top connector on Gas/Motor Control box.
14. Connect remaining end of short gas hose to barbed fitting on rear of motor/drive assembly housing by sliding end of hose onto barbed fitting.
15. Connect fitting on end of supplied long gas hose to bottom connector on Gas/Motor Control box.
16. Connect remaining end of long gas hose to flowmeter/regulator at shielding gas source.
17. Remove inlet guide on short inlet cable from original motor/drive assembly.
18. Install inlet guides on ends of inlet cables from supplied dual spindle and hub assemblies to both motor/drive assemblies.

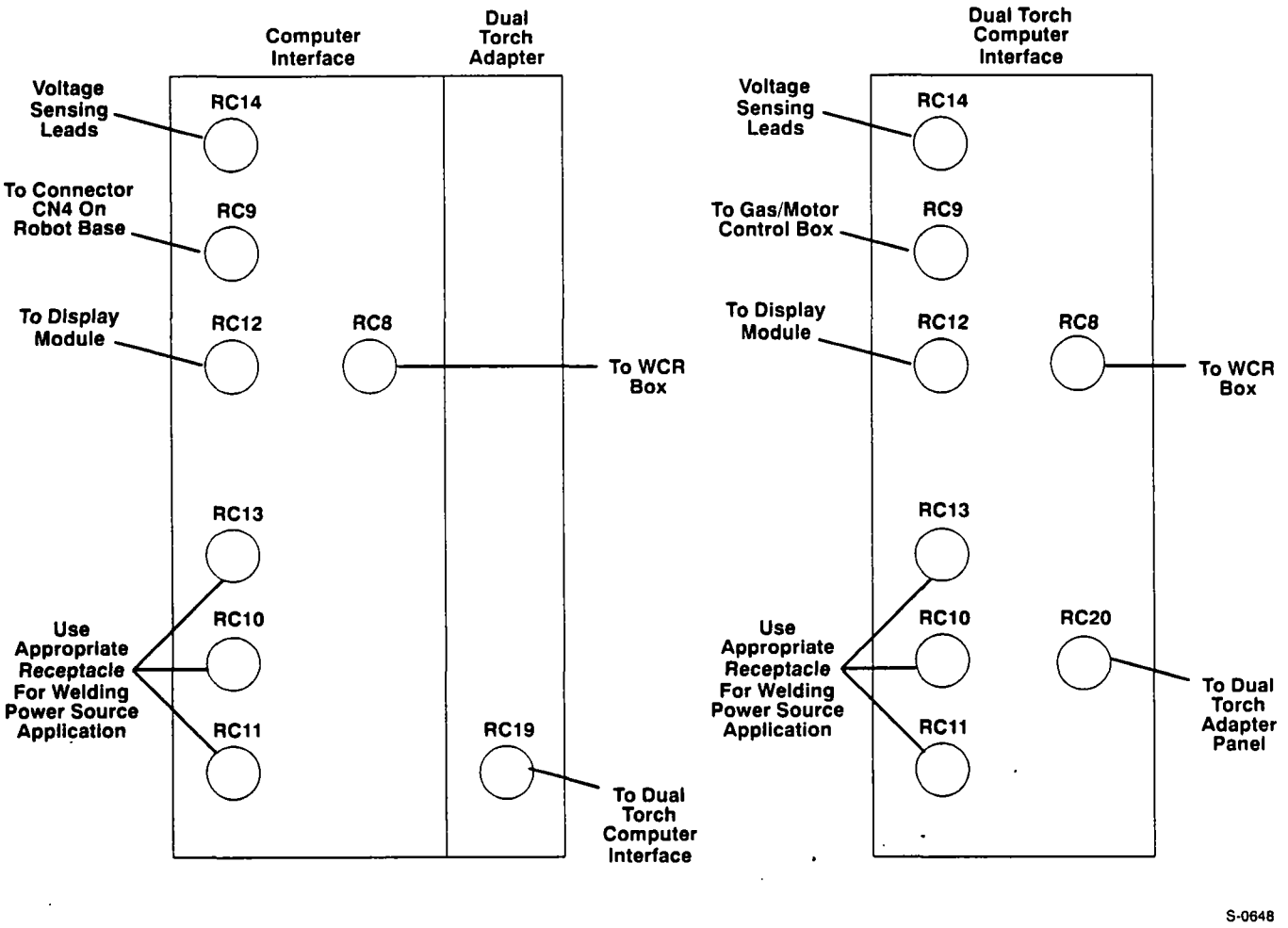


Figure 3-9. Connections At Computer Interfaces

3-9. WELDING POWER SOURCE – COMPUTER INTERFACE CONNECTIONS (Figure 3-9)

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down unit, welding power source, and robot, and disconnect input power employing lockout/tagging procedures before making interconnections.*

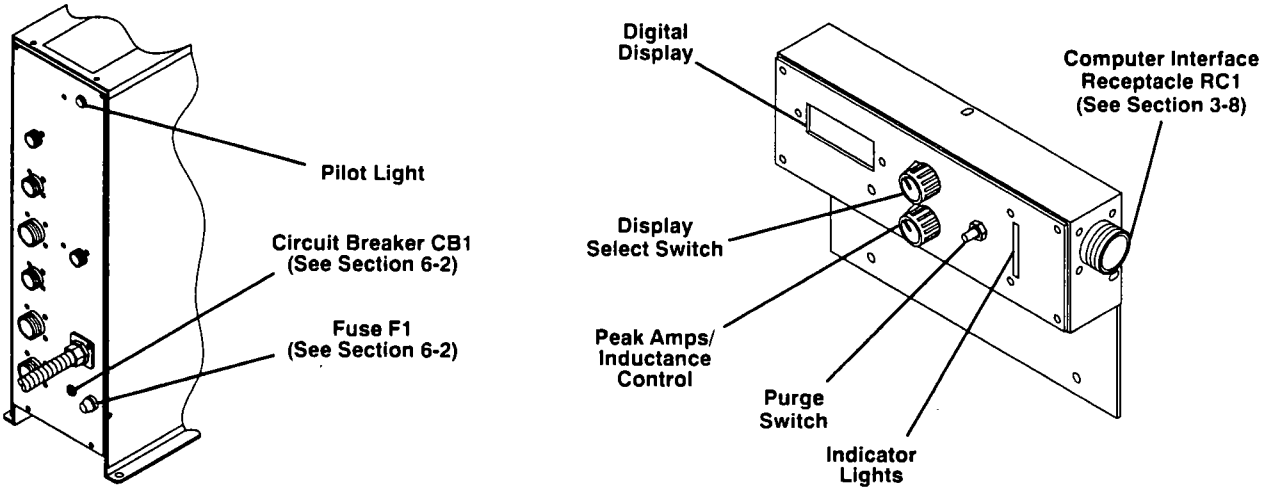
  Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

There are three receptacles to accommodate use of different welding power sources: Receptacle RC13 is a 10-pin receptacle, RC10 is a 17-pin receptacle and RC11 is a 14-pin receptacle. Determine which receptacle is required for the welding power source being used, select appropriate interconnecting cord, and make connections as follows: Align keyway, insert plug, and rotate threaded collar fully clockwise.

The remaining end of the interconnecting cord connects to the REMOTE receptacle on the welding power source. Align keyway, insert plug, and rotate threaded collar fully clockwise.

If the welding power source is equipped with both a 14 and 17-socket REMOTE receptacle, make connections to both and place the REMOTE 14/17 switch in the 14 position.

For multi-process welding power sources, rotate MAXIMUM GTAW OUTPUT control to maximum.



Computer Interface SC-136 571

Display Module SA-136 572

Figure 4-1. Front Panel Views

4-1. COMPUTER INTERFACE PILOT LIGHT

The pilot light turns on when 115 vac power is supplied to the Computer Interface from the welding power source.

4-2. REMOTE PENDANT CONTROL

A. Digital Display

The digital display shows either voltage, wire feed speed, peak amperage, or inductance depending on the setting of the Selector switch.

B. DISPLAY SELECT Switch

The Selector switch is used to select what appears on the digital display. The switch also selects whether the associated control is setting peak amperage or inductance.

C. PEAK AMPS/INDUCTANCE Control

This control sets peak amperage when the Selector switch is in the PEAK AMPERAGE position and the welding power source connected to the Computer Interface uses peak amperage.

The control sets inductance in percentage (0 to 100%) when the Selector switch is in the INDUCTANCE position and the welding power source connected to the Computer Interface uses inductance.

D. PURGE Switch

Pressing the PURGE switch energizes the gas valve on the robot. Use the PURGE switch to purge the gas line before beginning welding.

E. Indicator Lights

There are five indicator lights on the interface. These are visual indications of various process functions.

The POWER light turns on when 115 vac is supplied to the Computer Interface control and thereby the Display Module.

The GAS light turns on when the gas valve is energized to indicate shielding gas flow.

The CONTACTOR light turns on when the welding power source contactor is energized to indicate that weld output is available.

The WIRE FEED light turns on when the wire drive motor is energized to indicate that wire is feeding.

The WCR light turns on when the current detect relay is energized to indicate that an arc is established.

SECTION 5 – SEQUENCE OF OPERATION

WARNING: ELECTRIC SHOCK can kill; MOVING PARTS can cause serious injury; IMPROPER AIRFLOW AND EXPOSURE TO ENVIRONMENT can damage internal parts.

- *Do not touch live electrical parts.*
- *Keep all covers and panels in place while operating.*
- *Do not touch welding wire or any metal part in contact with it while welding.*

The welding wire and all metal parts in contact with it carry weld output when the welding power source contactor is energized.

Warranty is void if any of the equipment is operated with any portion of the outer enclosure removed.

ARC RAYS, SPARKS, AND HOT SURFACES can burn eyes and skin; NOISE can damage hearing.

- *Wear correct eye, ear, and body protection.*

FUMES AND GASES can seriously harm your health.

- *Keep your head out of the fumes.*
- *Ventilate to keep from breathing fumes and gases.*
- *If ventilation is inadequate, use approved breathing device.*

WELDING WIRE can cause puncture wounds.

- *Do not point gun toward any part of the body, any conductive surface, or other personnel.*

HOT METAL, SPATTER, AND SLAG can cause fire and burns.

- *Watch for fire.*
- *Keep a fire extinguisher nearby, and know how to use it.*
- *Do not use near flammable material.*
- *Allow work and equipment to cool before handling.*

MAGNETIC FIELDS FROM HIGH CURRENTS can affect pacemaker operation.

- *Wearers should consult their doctor before going near arc welding, gouging, or spot welding operations.*

See Section 1 - Safety Rules For Operation Of Arc Welding Power Source in the welding power source Owner's Manual for basic welding safety information.

5-1. GAS METAL ARC WELDING (GMAW)

1. Install and connect robot system according to its Owner's Manuals.
2. Connect Computer Interfaces according to Section 3.
3. Wear dry insulating gloves and clothing.
4. Prepare for welding by connecting work clamp(s) to clean, bare metal at workpiece.
5. Turn on and adjust shielding gas at its source.
6. Energize robot system.
7. Wear welding helmet with proper filter lens according to ANSI Z49.1.

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Do not touch electrode wire or any metal part in contact with it while welding.*

The electrode welding wire and all metal parts in contact with it carry weld output when the welding power source contactor is energized.

8. Begin welding.

5-2. SHUTTING DOWN

1. Stop welding.
2. Shut down robot system.
3. Turn off all associated equipment.
3. Turn off shielding gas at the source.

WARNING: HIGH CONCENTRATION OF SHIELDING GAS can harm health or kill.

- *Shut off gas supply when not in use.*

5-3. OPERATION OF COMPUTER INTERFACES (Chart 5-1)

The Computer Interfaces use signals from the welding power source(s) and Robot Control to control the gas valves, weld output, and wire feed speed.

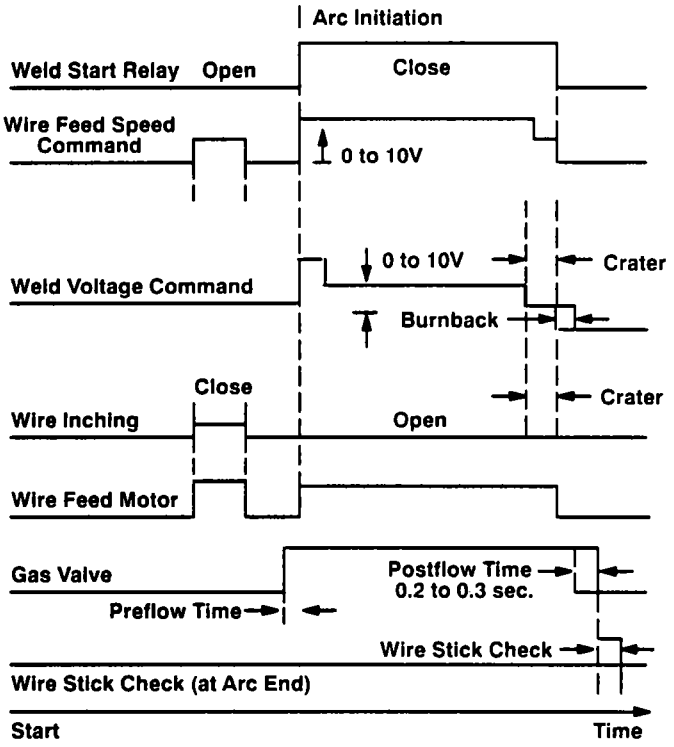
5-4. WIRE STICK CHECK (Chart 5-2)

1. A signal from the robot control indicates to the Computer Interface that the welding power source contactor is open at the end of a weld.
2. A voltage command signal is sent to the welding power source that ramps up from the value of the burnback setting. This increasing voltage command signal lasts until 100 milliseconds after the wire is freed.
3. The stick check circuitry is enabled after the weld current relay opens at the end of the weld.

IMPORTANT: *Wire stick check timing sequence only applies if DIP switches are set to enable this function (see Section 3-2).*

4. There is a delay of approximately 8 milliseconds.

Chart 5-1. Sequence Of Operation Timing

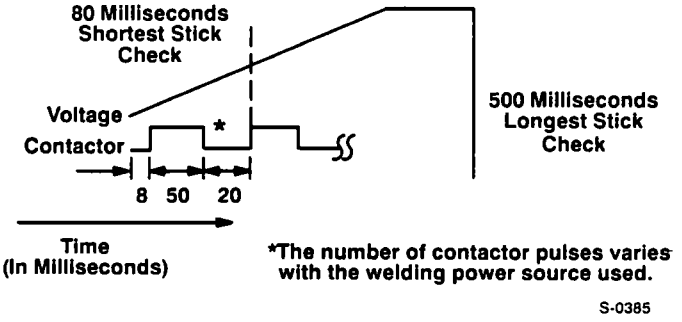


5. The welding power source contactor pulses on for a 50 to 75 millisecond time span. The weld current relay closes. During this pulse of the contactor, a signal is sent to the robot control indicating that current is flowing.
6. The robot looks for a 20 millisecond period of time that the weld current relay remains open. This indicates that the wire is free of the weld and the robot can continue.
7. If the Computer Interface sees the weld current relay close, it cycles through another 50 millisecond period of pulsing the contactor. The voltage command signal continues to ramp up.
8. This process of checking the weld current relay and pulsing the contactor continues until the wire is free of the weld or, at the end of 500 milliseconds, a weld abnormal code appears on the robot Program Module, if the wire stick function is enabled in the Robot System Data 3.

If System Data 3 Wire Stick Check is set to no (disabled), the robot may try to move even after the Computer Interface detects that the wire is stuck. A Weld Abnormal error code is likely to appear in this instance.

The Computer Interface may detect wire stuck even though the wire is free of the weld. Reset the robot and continue operation. If this occurs frequently, contact the nearest Factory Authorized Service Station.

Chart 5-2. Wire Stick Check Timing



IMPORTANT: *Voltage ramp only applies if DIP switches are set to enable this function and the wire stick check (see Section 3-2).*

SECTION 6 – MAINTENANCE & TROUBLESHOOTING

IMPORTANT: *Every six months inspect the labels on this unit for legibility. All precautionary labels must be maintained in a clearly readable state and replaced when necessary. See Parts List for part number of precautionary labels.*

6-1. INSPECTION AND UPKEEP

Usage and shop conditions will determine the frequency and type of maintenance. At minimum, inspect equipment every three months as follows:

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

MOVING PARTS can cause serious injury.

- *Keep away from moving parts.*

HOT SURFACES can cause severe burns.

- *Allow cooling period before servicing.*

Maintenance and troubleshooting to be performed only by qualified persons.

1. Inspect all interconnecting cords for damage to or breaks in the insulation jacket, particularly at the plugs. Repair or replace the cord(s) as necessary.
2. Remove grease and dirt from components and moisture from electrical parts and cables.

6-2. OVERLOAD PROTECTION

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down unit, welding power source, and robot, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

IMPROPER FUSE can damage unit.

- *Be sure replacement fuse is same size, type, and rating (see Parts List).*

A. Wire Drive Motor Circuit Breaker CB1

WARNING: Read and follow safety information at beginning of Section 6-2 before proceeding.

Circuit breaker CB1 protects the wire drive motor from overload. If CB1 opens, the wire feed circuit shuts down. If the breaker trips, correct the problem, and manually reset CB1.

B. Main Fuse F1

WARNING: Read and follow safety information at beginning of Section 6-2 before proceeding.

Fuse F1 protects the Computer Interface from an internal short or excessive overload . If fuse F1 opens, the Computer Interface shuts down. If the fuse opens, correct the problem and replace F1 as follows:

1. Depress and rotate fuse holder cover counterclockwise.
2. Pull out fuse with cover when fuse holder cover is free.
3. Insert new fuse into fuse holder cover.
4. Install fuse with fuse holder cover back into unit.
5. Depress and rotate fuse holder cover clockwise until cover is secure.

6-3. CIRCUIT BOARD HANDLING PRECAUTIONS

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

CAUTION: ELECTROSTATIC DISCHARGE (ESD) can damage circuit boards.

- *Put on properly grounded wrist strap BEFORE handling circuit boards.*
- *Transport circuit boards in proper static-shielding carriers or packages.*
- *Perform work only at a static-safe work area.*

INCORRECT INSTALLATION or misaligned plugs can damage circuit board.

- *Be sure that plugs are properly installed and aligned.*

EXCESSIVE PRESSURE can break circuit board.

- *Use only minimal pressure and gentle movement when disconnecting or connecting board plugs and removing or installing board.*

6-4. TROUBLESHOOTING

WARNING: ELECTRIC SHOCK can kill.

- *Do not touch live electrical parts.*
- *Shut down robot and welding power source, and disconnect input power employing lockout/tagging procedures before inspecting, maintaining, or servicing.*

Lockout/tagging procedures consist of padlocking line disconnect switch in open position, removing fuses from fuse box, or shutting off and red-tagging circuit breaker or other disconnecting device.

Troubleshooting of internal parts to be performed only by qualified persons.

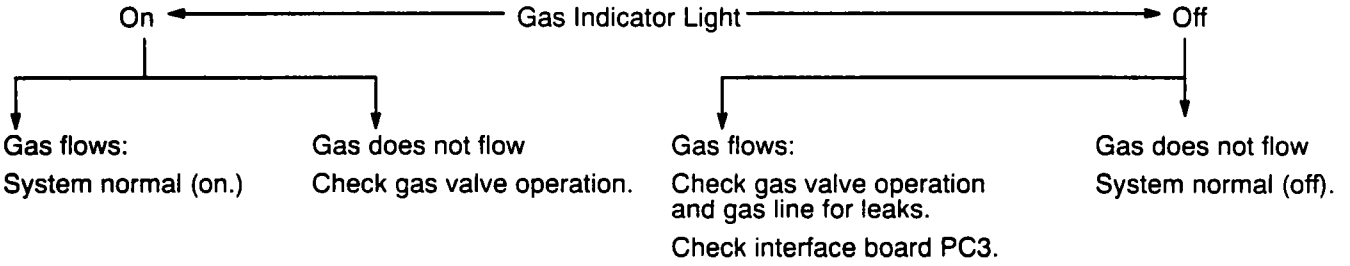
It is assumed that proper installation has been made according to Section 3 of this manual, the operator is familiar with the function of controls, the unit was working properly, and that the trouble is not related to the welding process. The following chart is designed to diagnose and provide remedies for some of the troubles that may develop in this unit.

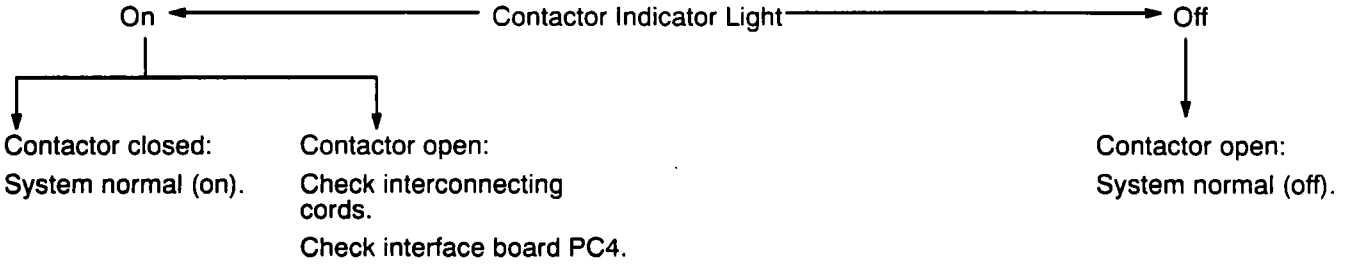
Use this chart in conjunction with the circuit diagram while performing troubleshooting procedures. If the trouble is not remedied after performing these procedures, contact the nearest Factory Authorized Service Station. In all cases of equipment malfunction, strictly follow the manufacturer's recommendations.

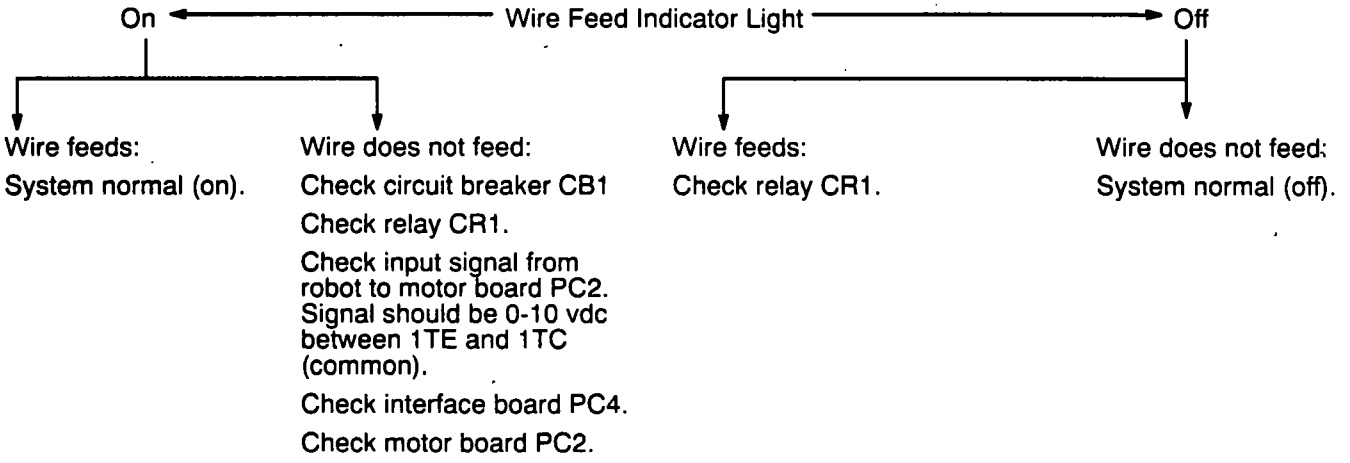
Table 6-1. Troubleshooting

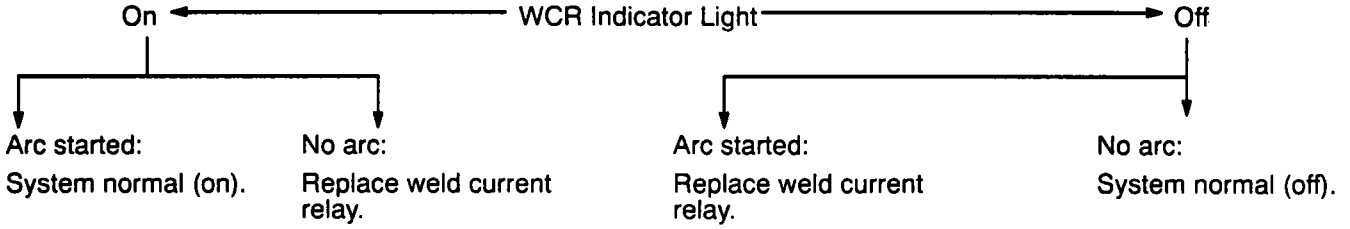
TROUBLE	PROBABLE CAUSE	REMEDY
Unit does not operate.	Fuse F1 open.	Check F1, and replace if necessary (see Section 6-2). Correct overload problem before continuing operation.
	Circuit breaker CB1 tripped.	Check CB1, and reset if necessary. Correct overload problem before continuing operation.
No meter display on Display Module.	Meter not working.	Replace meter (see Section 6-3 and contact Factory Authorized Service Station).
	Meter board PC1 not working.	Replace PC1 (see Section 6-3 and contact Factory Authorized Service Station).
No wire feed.	Relay CR1 not working.	Replace CR1.
	Motor board PC2 not working.	Replace PC2 (see Section 6-3 and contact Factory Authorized Service Station).
	Interface board PC4 not working.	Replace PC4 (see Section 6-3 and contact Factory Authorized Service Station).
Wire feeds at maximum.	Tach board at wire drive motor not working.	Replace tach board. See wire drive assembly Owner's Manual.
No arc voltage control.	Voltage control connections.	Check and secure connections (see Section 3-8).
	Voltage sensing connections.	Check and secure connections (see Section 3-3).
	Position of Remote Voltage control switch on welding power source.	Remote Voltage control switch on welding power source must be in position to allow remote control.
	Voltage board PC1 not working.	Replace PC1 (see Section 6-3 and contact Factory Authorized Service Station).
	Incorrect robot command voltage.	Check robot command voltage to voltage board PC1. Command voltage should be 0-10 Vdc between 3TC and 3TB (common).
	Welding power source MAXIMUM GTAW OUTPUT control.	Rotate control to maximum position.
	Interface board PC4 not working.	Replace PC4 (see Section 6-3 and contact Factory Authorized Service Station).
Robot moves when welding wire is stuck.	Wire stick check DIP switches.	Be sure DIP switches are in desired position (see Section 3-2).
	Current sensing connections.	Check and secure connections (see Section 3-3).
Wire speed meter goes to zero.	Incorrect robot command voltage.	Check robot command voltage to motor board PC2. Signal should be 0-10 vdc between 1TE and 1TC (common).
	Motor board PC2 not working.	Replace PC2 (see Section 6-3 and contact Factory Authorized Service Station).
No wire retract.	Communication board PC3 not working.	Replace PC3 (see Section 6-3 and contact Factory Authorized Service Station).
	Incorrect robot command voltage.	Check robot command voltage at motor board PC2. Signal should be 0-10 vdc between 1TE and 1TC (common).
Robot shuts down.	Loose weld output connections.	Clean and tighten connections.
	Interconnecting cords.	Check all interconnecting cords for breaks; repair or replace. Check and secure all connections.
	Communication board PC3 not working.	Replace PC3 (see Section 6-3 and contact Factory Authorized Service Station).

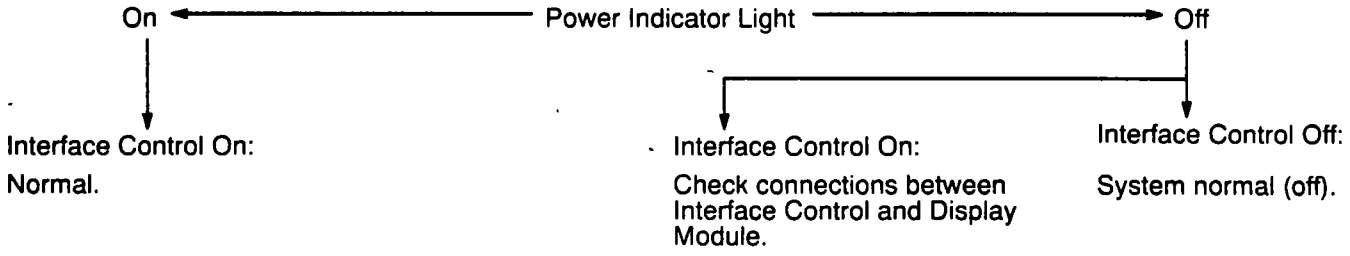
6-5. USE OF INDICATOR LIGHTS FOR TROUBLE-SHOOTING

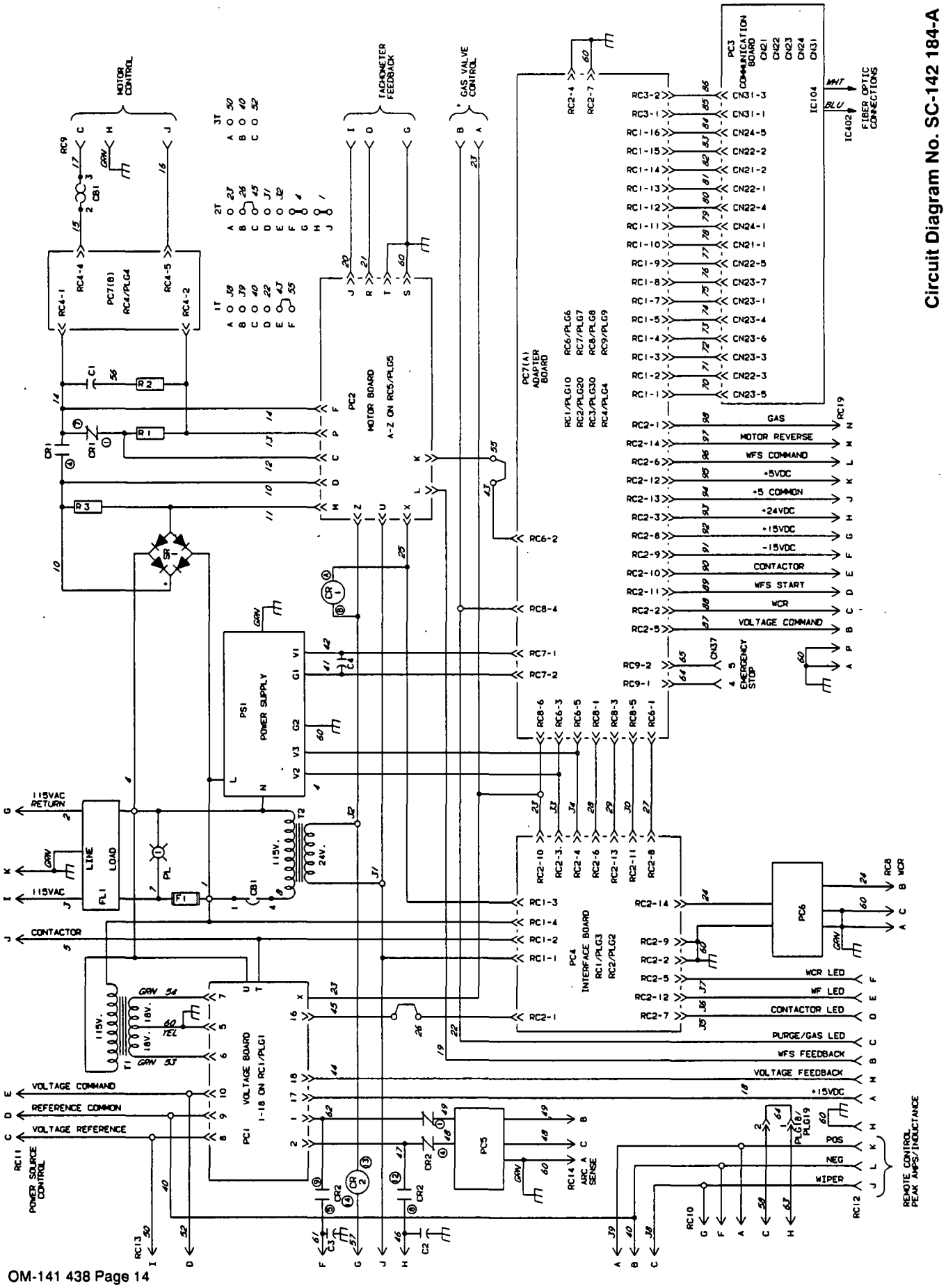





On
Wire Feed Indicator Light
Off
Wire feeds:
System normal (on).
Wire does not feed:
Check circuit breaker CB1
Check relay CR1.
Check input signal from robot to motor board PC2. Signal should be 0-10 vdc between 1TE and 1TC (common).
Check interface board PC4.
Check motor board PC2.
Wire feeds:
Check relay CR1.
Wire does not feed:
System normal (off).

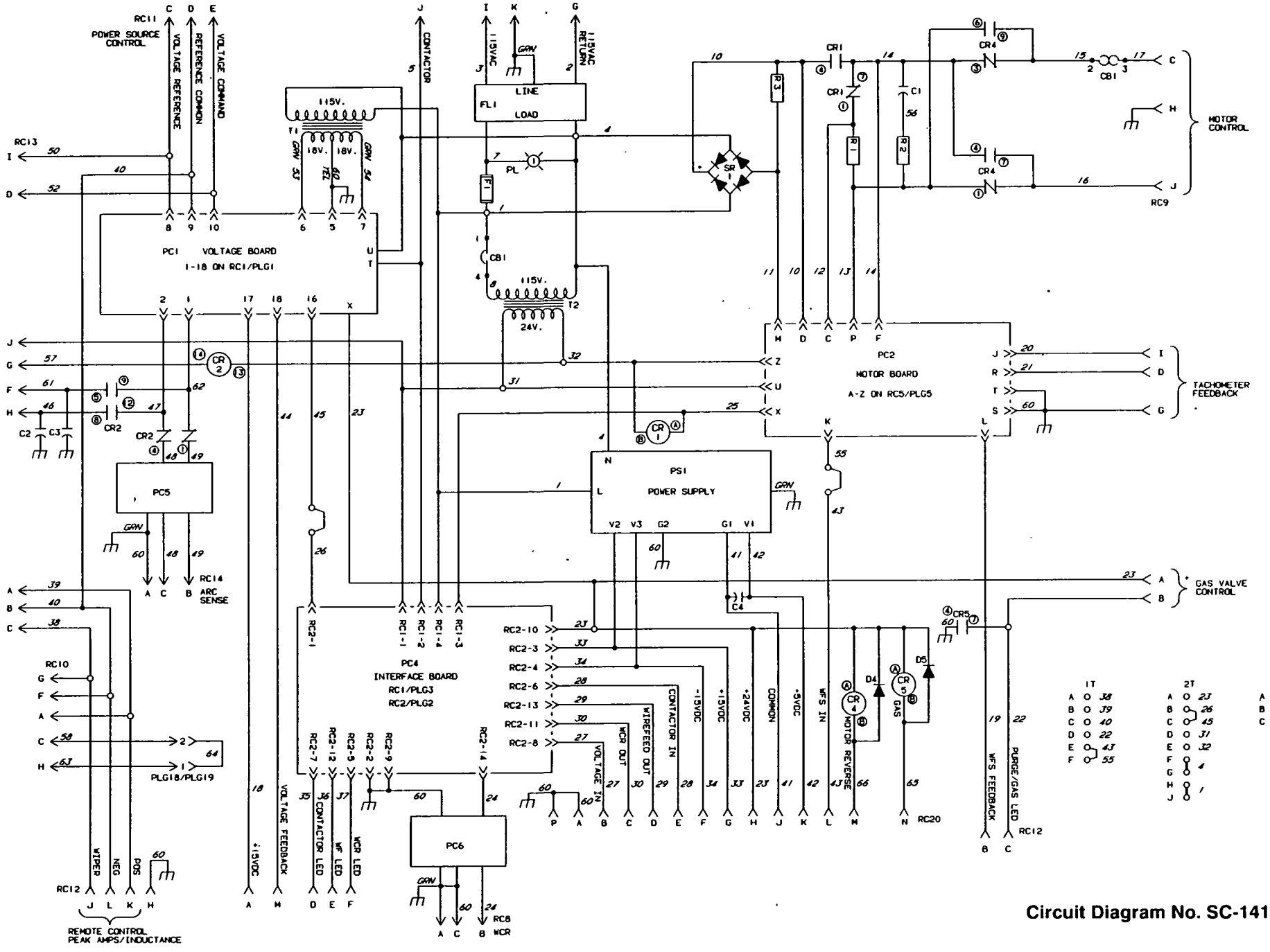






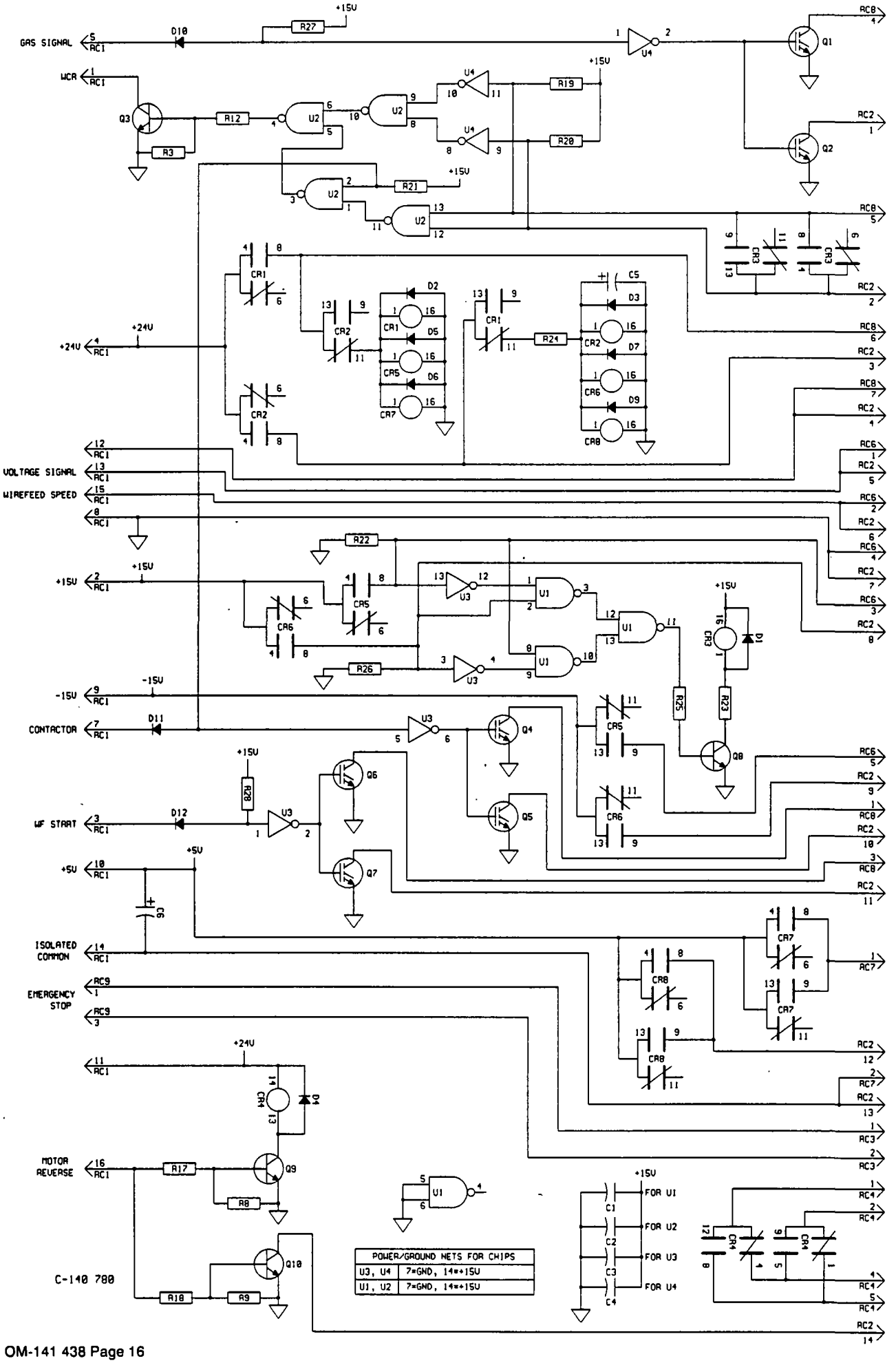
Circuit Diagram No. SC-142 184-A

Diagram 7-1. Circuit Diagram For Computer Interface With Dual Torch Adapter Panel



Circuit Diagram No. SC-141 410-A

Diagram 7-2. Circuit Diagram For Dual Torch Computer Interface



Circuit Diagram No. SC-140 780-A

Diagram 7-3. Circuit Diagram For Adapter Board PC7

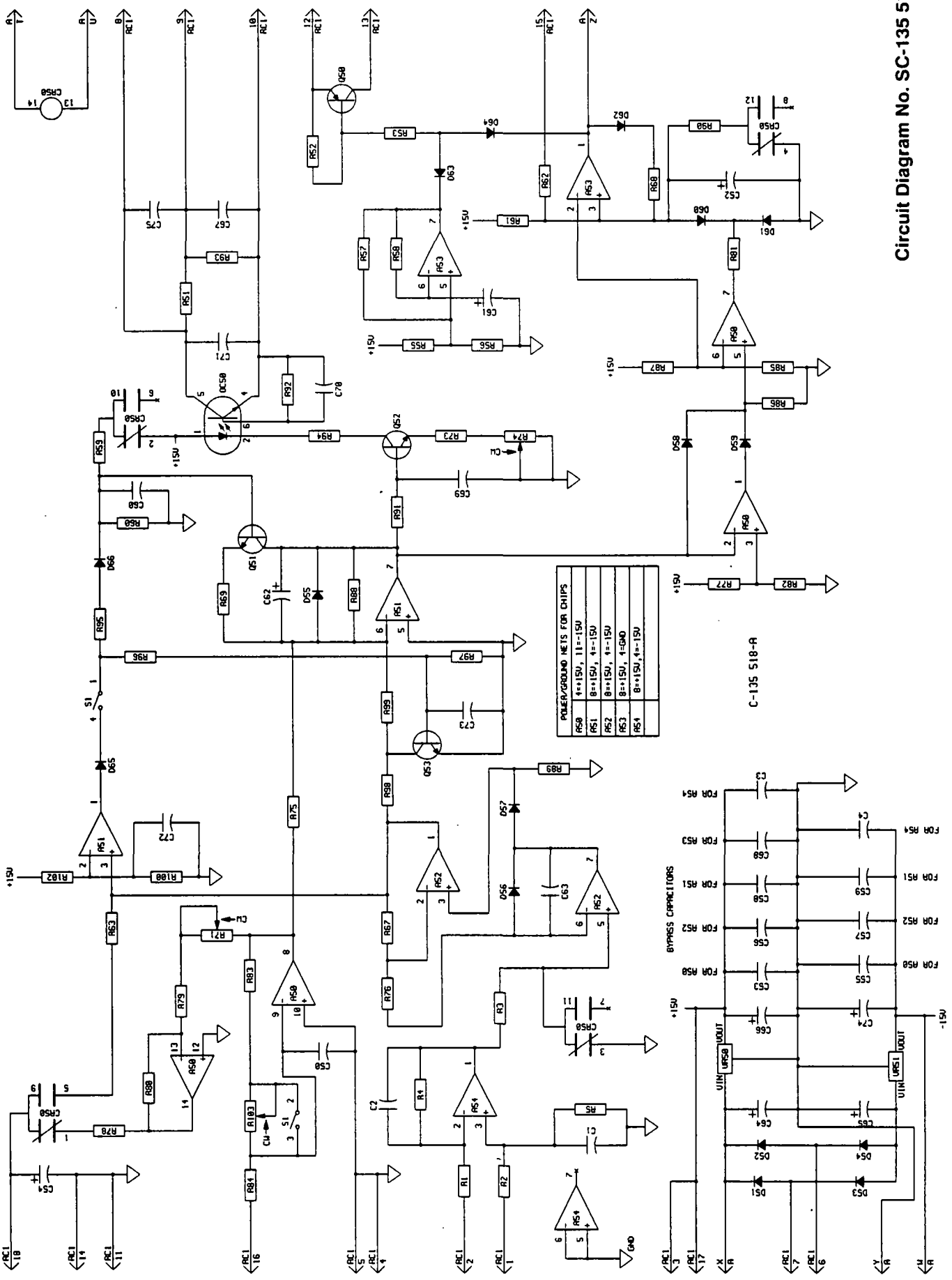


Diagram 7-4. Circuit Diagram For Voltage Board PC1

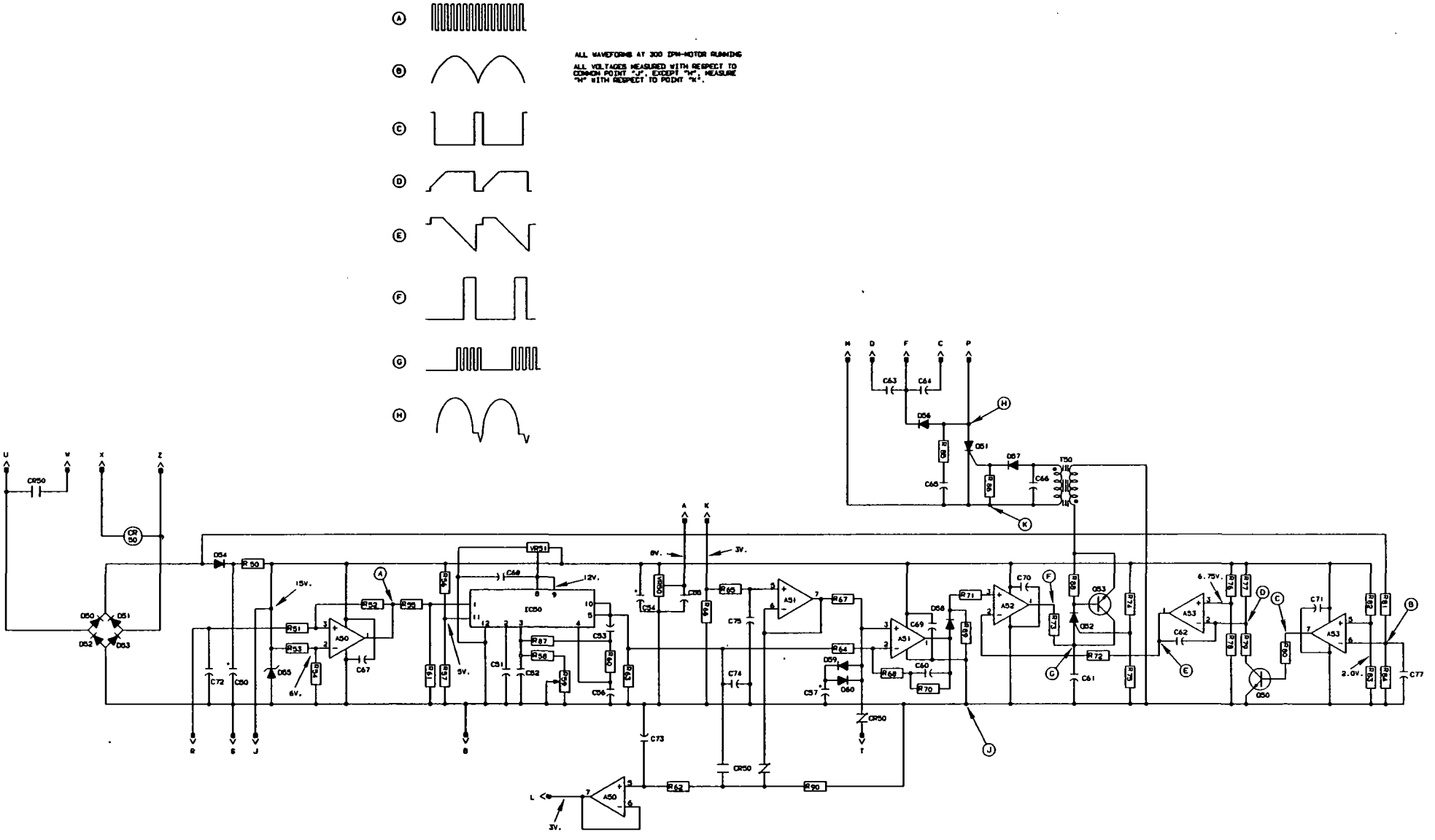
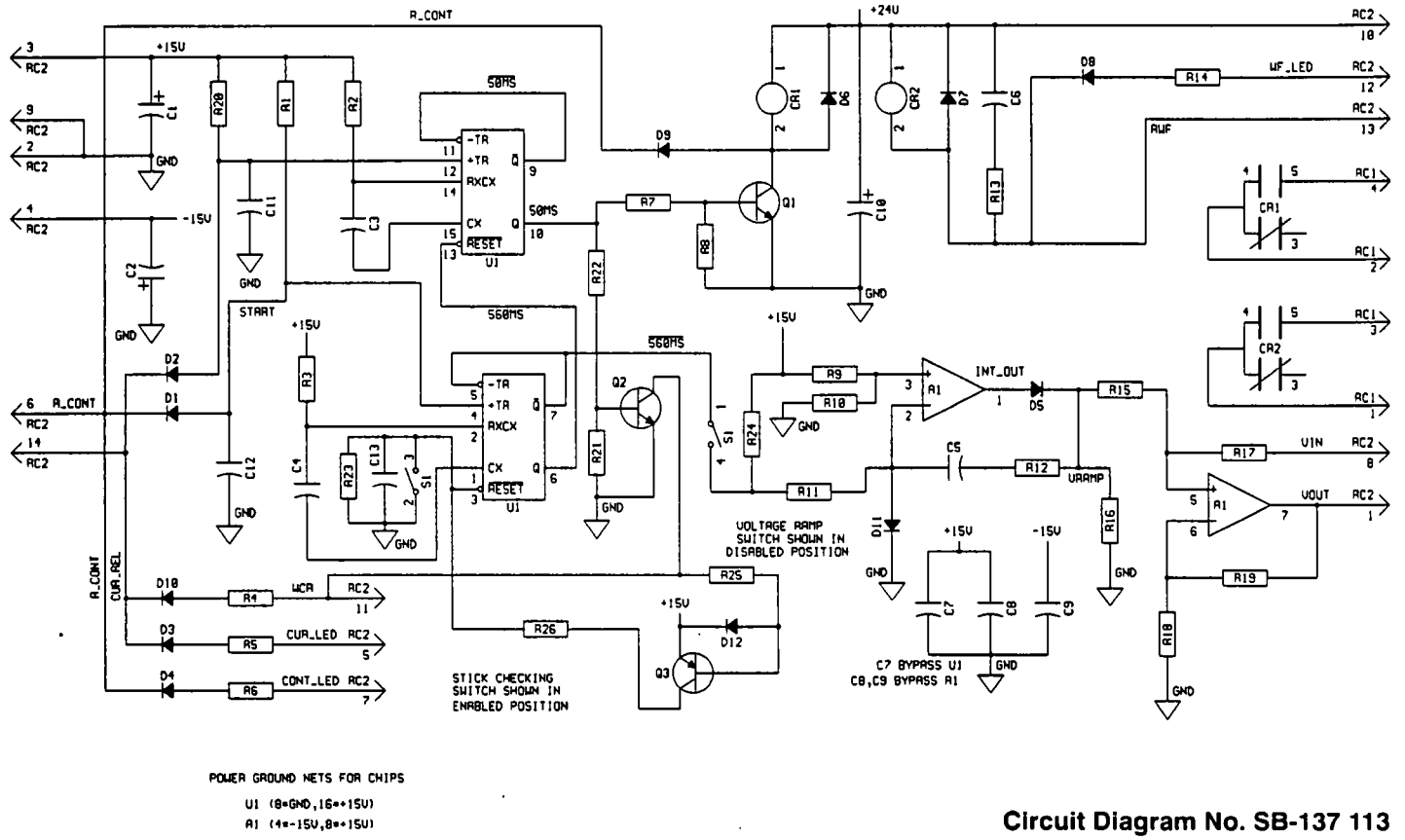
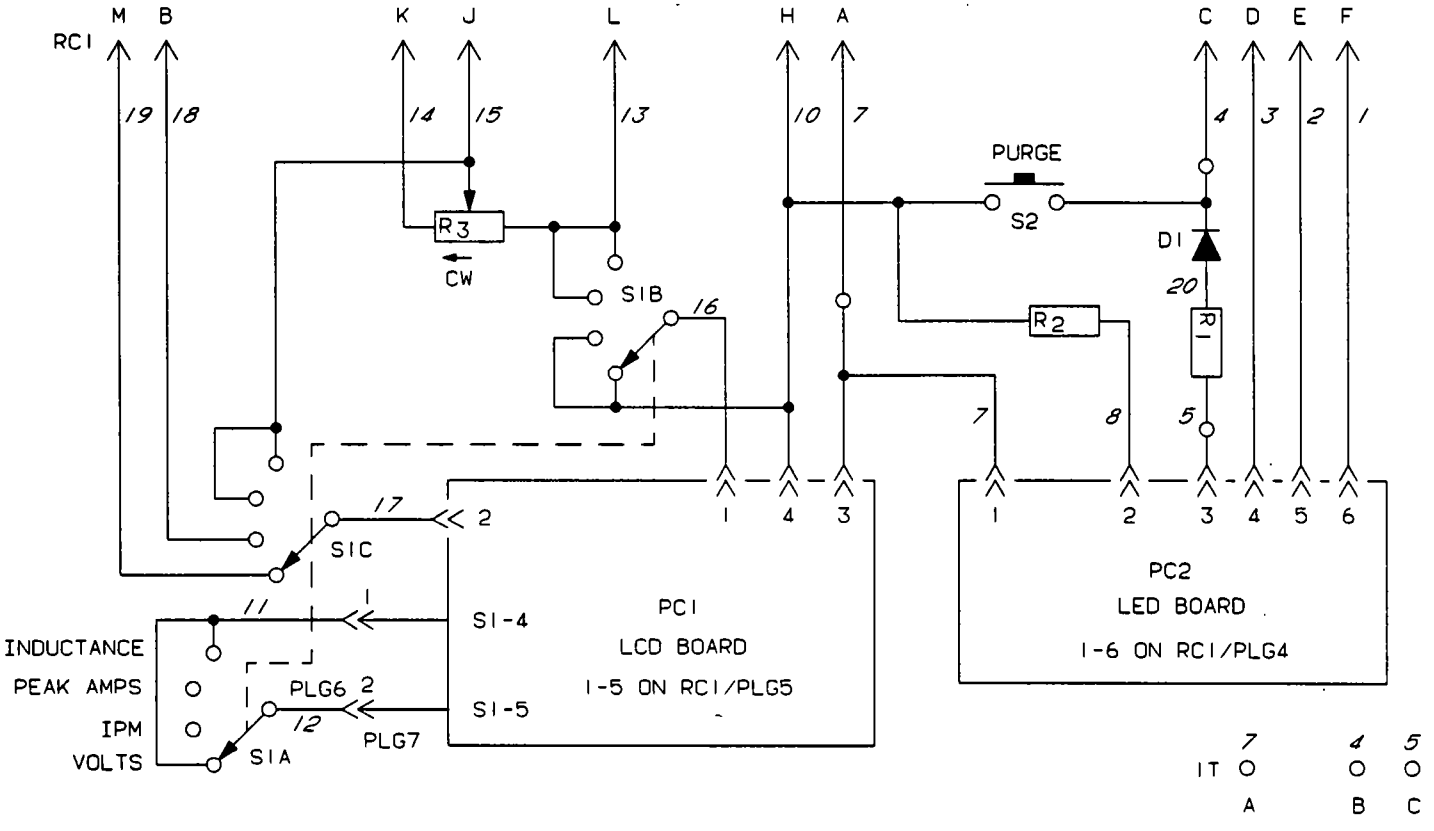

ALL WAVEFORMS AT 300 RPM-MOTOR RUNNING
ALL VOLTAGES MEASURED WITH RESPECT TO COMMON POINT "J", EXCEPT "W" MEASURE "W" WITH RESPECT TO POINT "K".
Circuit Diagram No. SD-083 388-A

Diagram 7-5. Circuit Diagram For Motor Board PC2



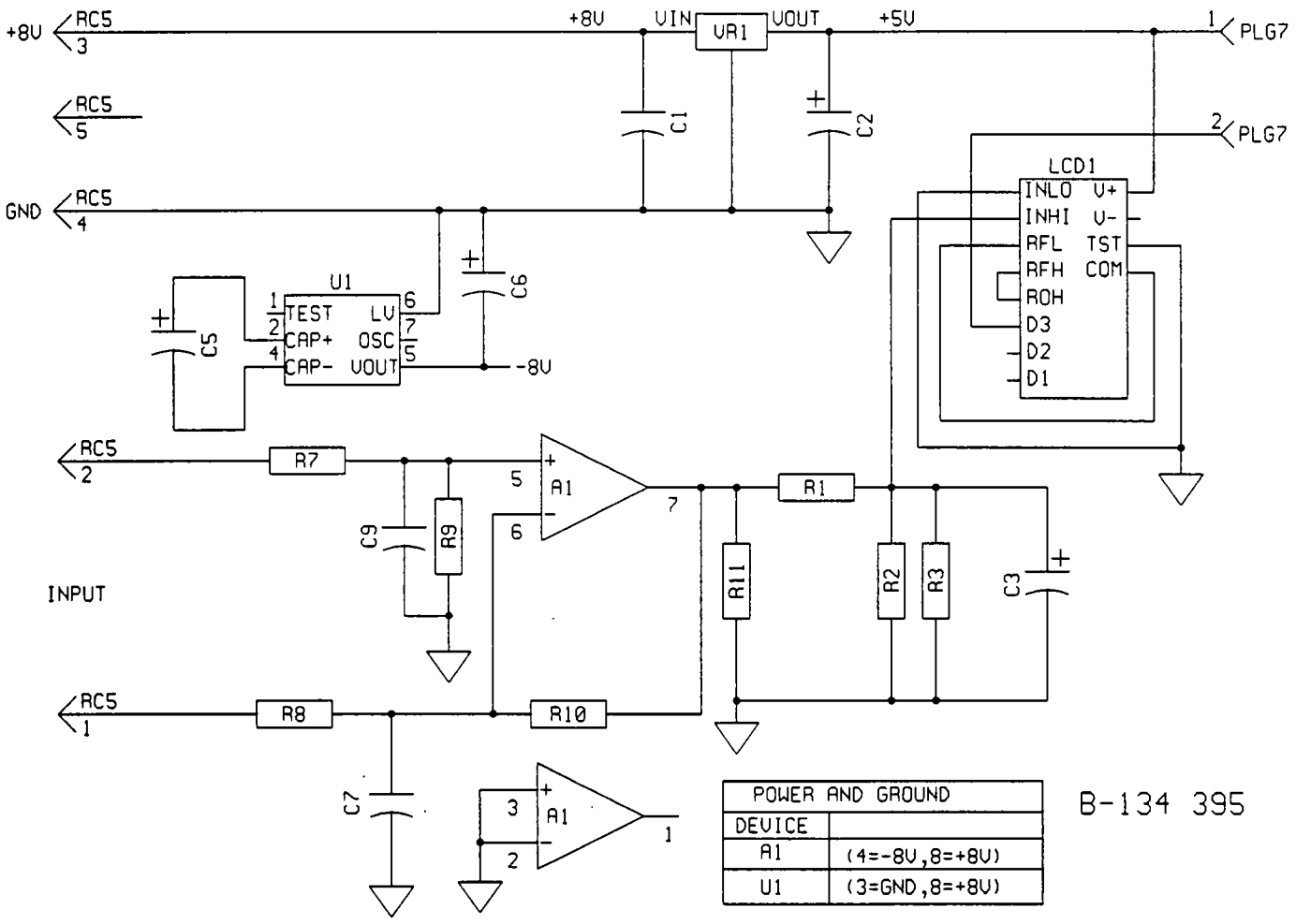
Circuit Diagram No. SB-137 113

Diagram 7-6. Circuit Diagram For Interface Board PC4



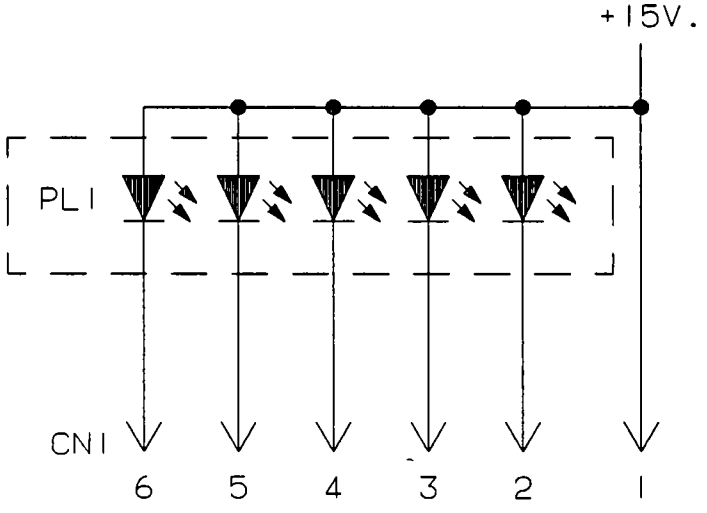
Circuit Diagram No. SA-134 047-A

Diagram 7-7. Circuit Diagram For Display Module



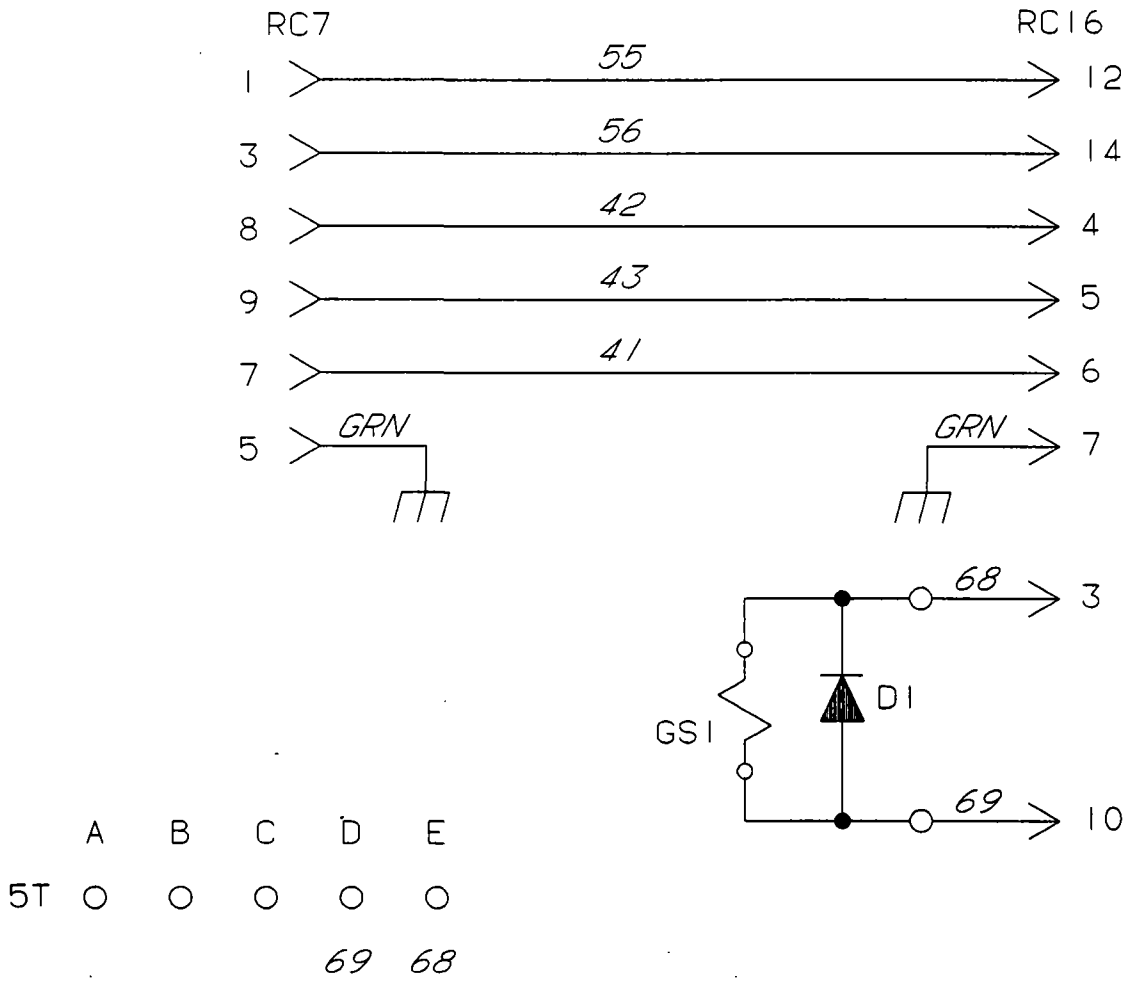
Circuit Diagram No. SB-134 395

Diagram 7-8. Circuit Diagram For Display Module Meter Board PC1



Circuit Diagram No. SA-129 640

Diagram 7-9. Circuit Diagram For Display Module LED Board PC2



Circuit Diagram No. SA-141 554

Diagram 7-10. Circuit Diagram For Gas/Motor Control Box

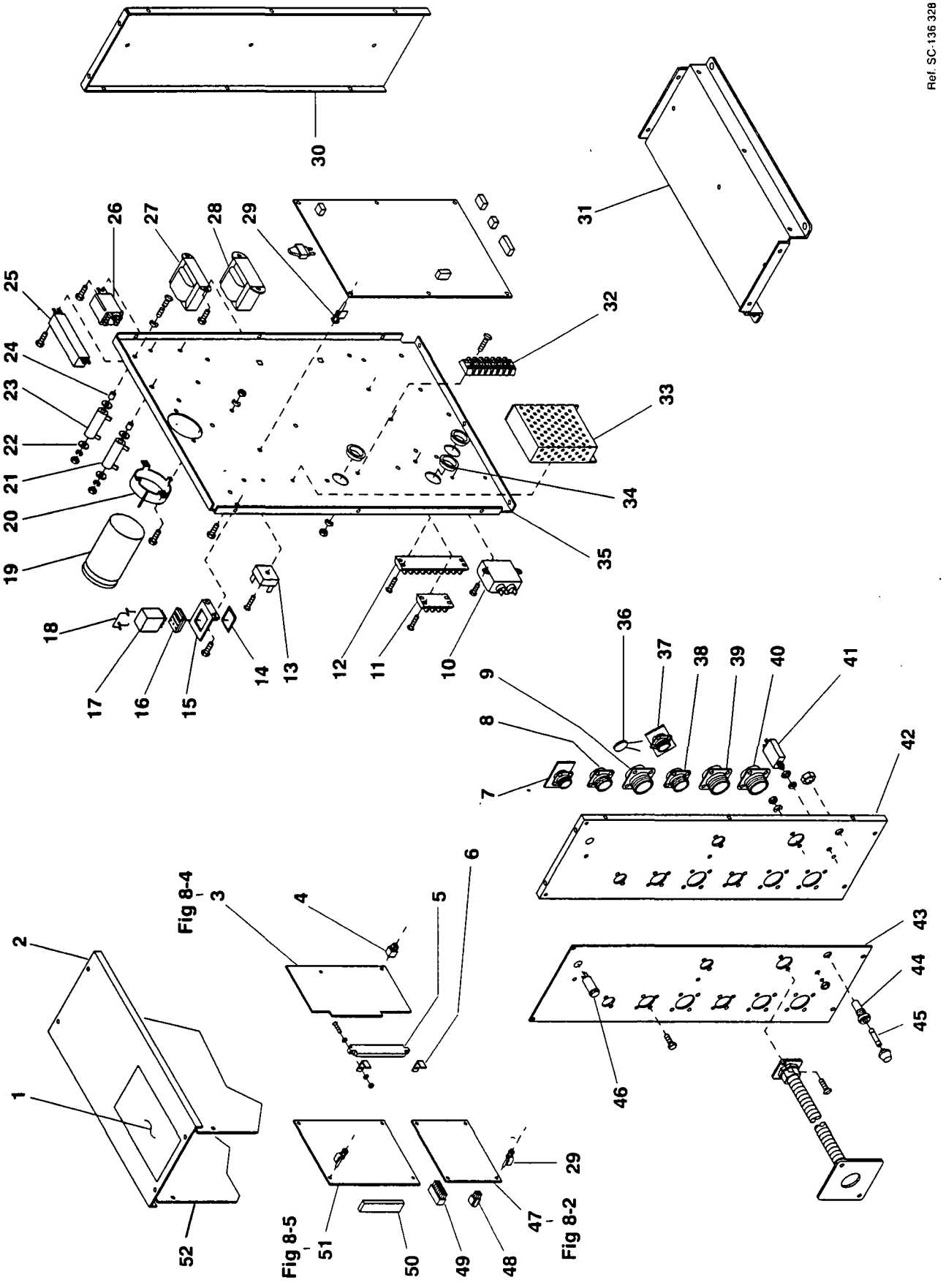


Figure 8-1. Main Assembly (For Reference Only And May Not Reflect Actual Product)

Item No.	Dia. Mkgs.	Part No.	Description	Quantity

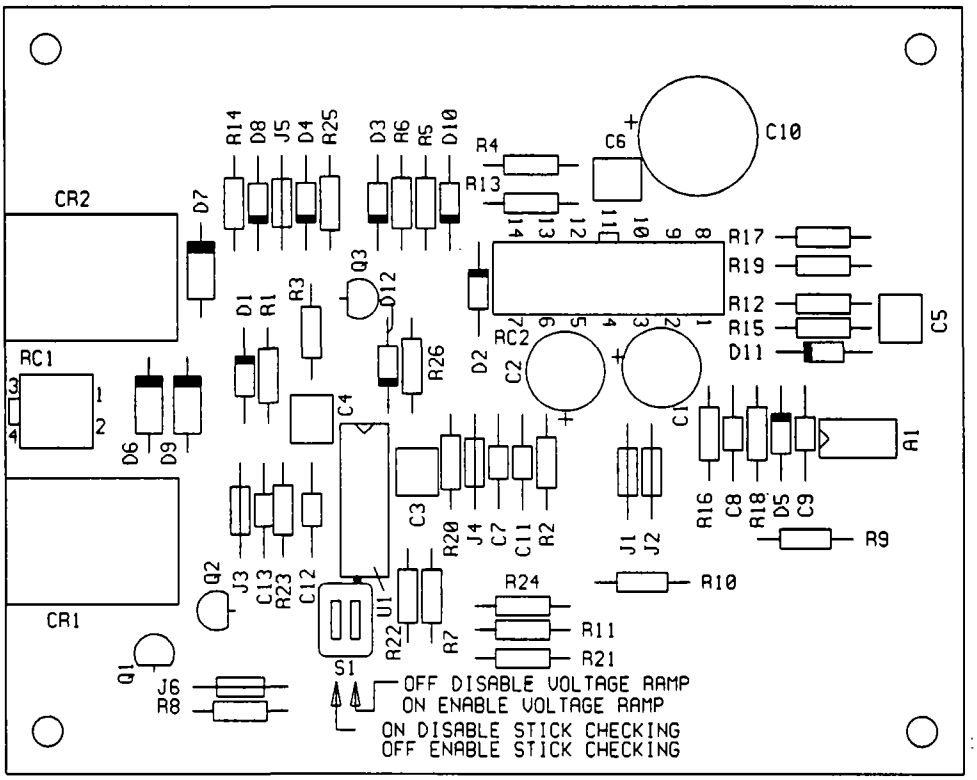
Figure 8-1. Main Assembly

1		134 464	LABEL, warning general precautionary	1
2		+133 862	COVER	1
3	PC2	071 642	CIRCUIT CARD, motor speed digital (Fig 8-4)	1
4		083 147	GROMMET, scr No 8/10	2
5	RC5	117 374	HOUSING, term conn 22posn	1
6		031 251	BRACKET, mtg connector	2
7	RC14,PC5	142 634	RECEPTACLE, w/components	1
8	RC9	039 718	RECEPTACLE, 10skt MS-3102A-18-1S	1
9	RC12	073 515	RECEPTACLE, 11skt 97-3102A-20-33S	1
10	FL1	084 171	FILTER, line pwr 115/250V 50-400Hz	1
11	3T	038 861	BLOCK, term 20A 3P	1
12	2T	038 832	BLOCK, term 20A 9P	1
		601 219	LINK, jumper term blk 20A	4
13	SR1	035 704	RECTIFIER, integ 30A 600V	1
14		048 029	CLIP, retaining socket relay	1
15		049 970	BRACKET, mtg relay	1
16		027 811	SOCKET, relay 14 pin	1
17	CR2	095 033	RELAY, encl 24VAC 4PDT	1
18		079 844	SPRING, hold down relay	1
19	C1	031 692	CAPACITOR, elctlt 750uf 200VDC	1
20		006 426	CLAMP, capacitor 2.000dia	1
21	R3	079 497	RESISTOR, WW fxd 25W 2K ohm	1
22		073 914	WASHER, centering .437dia	4
23	R1	030 651	RESISTOR, WW fxd 25W 10 ohm	1
24		010 301	BUSHING, al .140 ID x .250 OD x .312	2
25	R2	030 941	RESISTOR, WW fxd 100W 5 ohm	1
26	CR1	109 006	RELAY, encl 24VAC DPDT	1
27	T1	035 759	TRANSFORMER, control mintr 115/36VCT	1
28	T2	036 135	TRANSFORMER, control 115/24VAC 50/60Hz	1
29		110 375	STAND-OFF SUPPORT, PC card No. 6scr	8
	CR4,5	052 964	RELAY, encl 24VDC DPDT	2
	RC20	073 973	RECEPTACLE, 14skt MS-3102A-22-19S	1
	D4,5	026 202	DIODE, rect 1A 400V SP	2
30		133 867	PANEL, rear	1
31		133 870	BASE	1
32	1T	038 772	BLOCK, term 20A 6P	1
33	PS1	125 966	POWER SUPPLY, switching 85-132VAC/110-170VDC	1
	C4	148 596	CAPACITOR	1
34		030 170	BUSHING, snap-in nyl .750 ID x 1.000mtg hole	3
35		133 872	PANEL, mtg components	1
36	C2	044 176	CAPACITOR, cer disc .01uf 1000VDC	1
37	RC8,PC6	133 861	RECEPTACLE, w/components	1
38	RC13	089 646	RECEPTACLE, 10 pin MS-3102A-18-1P	1
39	RC10	097 867	RECEPTACLE, 17 pin MS-3102A-20-27P	1
	PLG20	135 635	HOUSING PLUG & PINS, (consisting of)	1
		114 656	. . TERMINAL, male 1 pin 24-18 wire	2
	PLG21	131 054	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
		113 746	. . TERMINAL, female 1skt 24-18 wire	2
40	RC11	094 480	RECEPTACLE, 14 pin MS-3102A-20-27P	1
41	CB1	011 991	CIRCUIT BREAKER, man reset 1P 1.5A 250V	1
42		1338710009288	PANEL, front	1
43			NAMEPLATE, (order by model and serial number)	1
44		046 432	HOLDER, fuse mintr .250 x 1.250 panel mtg	1
45	F1	*012 655	FUSE, mintr cer 10A 250V	1
46	PL1	074 188	LIGHT, ind red lens	1
47	PC4	137 110	CIRCUIT CARD, interface (Fig 8-2)	1
48	PLG3	115 094	HOUSING PLUG & SOCKETS, (consisting of)	1
		113 746	. . TERMINAL, female 1skt 24-18 wire	4
49	PLG2	131 056	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
		113 746	. . TERMINAL, female 1skt 24-18 wire	14
50	PLG1	079 748	HOUSING, term hdr 18 pin posn	1

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
			Figure 8-1. Main Assembly (Continued)	
		079 747	. . TERMINAL, contact hdr 24-18 wire	18
51	PC1	137 695	. . CIRCUIT CARD, voltage control (Fig 8-5)	1
52		133 868	. . PANEL, side	2
		133 863	. . CABLE, interconnecting (consisting of)	1
		094 481	. . . . PLUG, 14 pin MS-3106A-20-27P	1
		116 964	. . . . CLAMP, cable 97-3057-1012	2
		110 015	. . . . CABLE, port No. 18 7/c	5ft
		094 482	. . . . PLUG, 14skt 3106A-20-27S	1
		133 864	. . CABLE, interconnecting (consisting of)	1
		097 868	. . . . PLUG, 17skt MS-3106A-20-29S	1
		116 964	. . . . CLAMP, cable 97-3057-1012	2
		604 910	. . . . CABLE, pwr shld 20ga 5/c (order by ft)	5ft
		097 866	. . . . PLUG, 17 pin MS-3106A-20-29P	1
		133 865	. . CABLE, interconnecting (consisting of)	1
		089 647	. . . . PLUG, 10SKT MS-3106A-18-1S	1
		073 332	. . . . CLAMP, cable AN-3057-10	2
		073 140	. . . . CABLE, port No. 18 10/c (order by ft)	5ft
		039 716	. . . . PLUG, 10 pin MS-3106A-18-1P	1
		133 866	. . CABLE, volt sense (consisting of)	1
		073 686	. . . . PLUG, 4skt 97-3106A-14S-2S	1
		039 828	. . . . CLAMP, cable AN-3057-6	1
		133 859	. . . . CABLE, coaxial 18ga 1/c 60C 300V (order by ft)	70ft
		083 184	. . . . TERMINAL, ring tng .500 stud 22-16 wire	2
		070 584	. . . . TUBING, gl acrylic No. 9 (order by ft)	1ft
		084 286	. . . . TUBING, htshnk .250dia (order by ft)	1ft
		1343080009288	. . CABLE, interconnecting (consisting of)	1
		039 716	. . . . PLUG, 10 pin MS-3106A-18-1P	1
		073 332	. . . . CLAMP, cable AN-3057-10	1
		134 242	. . . . CABLE, port No. 18 10/c (order by ft)	23ft
		048 598	. . . . HOUSING PLUG & SOCKETS, (consisting of)	1
		079 534	. . . . . TERMINAL, female 1skt 18-14 wire	16
		079 739	. . . . CLAMP, strain relief	1
		134 471	. . CABLE, interconnecting (consisting of)	1
		073 517	. . . . PLUG, 11 pin 97-3106A-20-33P	1
		039 734	. . . . CLAMP, cable AN-3057-12	2
		134 240	. . . . CABLE, port No. 20 12/c (order by ft)	26ft
		134 106	. . . . PLUG, 11skt MS-3108B-20-33S	1
		1264930009288	. . CABLE, combination (consisting of)	1
		1264980009288	. . . . CABLE/CONDUIT, 7ft	1
		084 594	. . . . LINER, monocoil .030-.035 wire	1
		049 310	. . . . GUIDE, wire outlet .030-.035	1
		1408550009288	. . CABLE, interconnecting (consisting of)	1
		096 813	. . . . CABLE, pwr shld 18ga 15/c (order by ft)	8ft
		073 982	. . . . PLUG, 14 pin MS-3106A-22-19P	1
		140 840	. . . . PLUG, 14skt MS-3106A-22-19S	1
		116 964	. . . . CLAMP, cable 97-3057-1012	2
		056 423	. . HOSE, gas (consisting of)	1
		010 603	. . . . FITTING, hose brs barbed nipple 1/4tbg	2
		010 606	. . . . FITTING, hose brs nut .625-18RH	2
		051 297	. . . . ADAPTER	1
		056 112	. . . . FITTING, hose brs ferrule .475 ID x .718 lg	2
		603 106	. . . . HOSE, nprn brd No. 1 x .250 ID (order by ft)	33ft
		127 750	. . HOSE, gas (consisting of)	1
		010 606	. . . . FITTING, hose brs nut .625-18RH	1
		056 108	. . . . FITTING, hose brs ferrule .425 ID x .718 lg	1
		056 851	. . . . FITTING, hose brs barbed nipple 3/16tbg	1
		604 550	. . . . HOSE, nprn brd No. 1 x .187 ID (order by ft)	3ft

+When ordering a component originally displaying a precautionary label, the label should also be ordered.
*Recommended Spare Parts.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

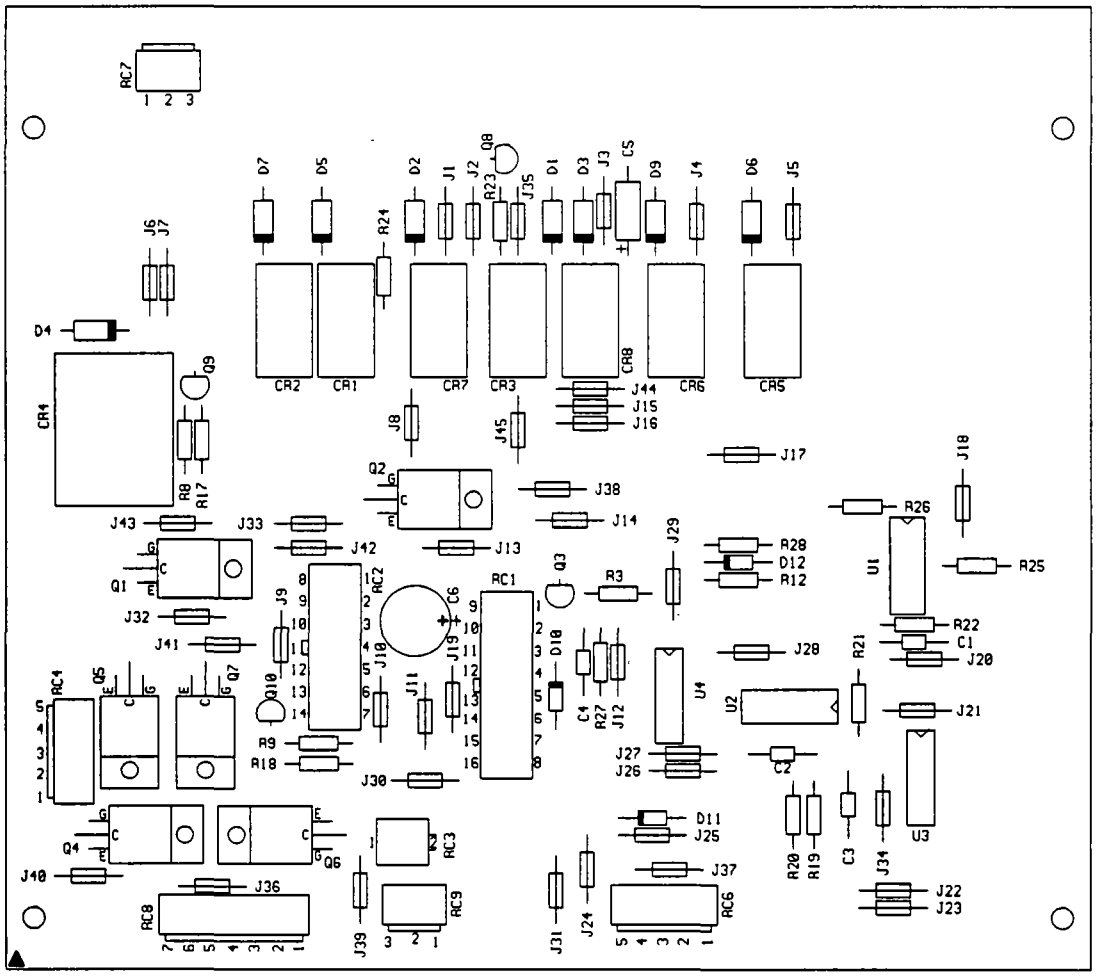
Dia. Mkgs.	Part No.	Description	Quantity
PC4	**137 110**	**Figure 8-2. Circuit Card, Interface (Fig 8-1 Item 47)**	
.... A1	114 176 ..	IC, linear 353	1
.... C1,2	118 460 ..	CAPACITOR, elctlt 330uf 50VDC	2
.... C3-6	125 500 ..	CAPACITOR, polye met film 1.0uf 50VDC	4
. C7-9,11-13	122 723 ..	CAPACITOR, cer mono .1uf 50VDC	6
.... C10	083 973 ..	CAPACITOR, elctlt 1000uf 35VDC	1
... CR1,2	099 018 ..	RELAY, encl 24VDC SPDT	2
D1-5,8,10-12 ...	028 351 ..	DIODE, sig .020A 75V SP	9
... D6,7,9	026 202 ..	DIODE, rect 1A 400V SP	3
.... J1-6	092 648 ..	RESISTOR, WW fxd zero ohm	6
.... Q1,2	037 200 ..	TRANSISTOR, NPN 200MA 40V	2
.... Q3	037 201 ..	TRANSISTOR, PNP 200MA 40V	1
R1,7,11,22,26 ..	035 827 ..	RESISTOR, CF .25W 10K ohm	5
.... R2	000 007 ..	RESISTOR, MF .25W 61.9K ohm	1
.... R3	052 146 ..	RESISTOR, MF .25W 619K ohm	1
... R4,13	035 823 ..	RESISTOR, CF .25W 100 ohm	2
.. R5,6,14	044 633 ..	RESISTOR, MF .25W 1.21K ohm	3
... R8,21	035 825 ..	RESISTOR, CF .25W 1K ohm	2
.... R9	052 138 ..	RESISTOR, MF .25W 20K ohm	1
.... R10	044 634 ..	RESISTOR, MF .25W 332 ohm	1
.... R12	035 888 ..	RESISTOR, CF .25W 2.2K ohm	1
... R15,16	089 175 ..	RESISTOR, MF .25W 10K ohm	2
... R17-19	089 176 ..	RESISTOR, MF .25W 20K ohm	3
. R20,24,25	035 884 ..	RESISTOR, CF .25W 100K ohm	3
.... R23	094 040 ..	RESISTOR, MF .25W 1 meg ohm	1
.... RC1	113 748 ..	TERMINAL, header 4 pin	1
.... RC2	117 864 ..	TERMINAL, header 14 pin	1
.... S1	109 481 ..	SWITCH, DIP SPST 2posn	1
.... U1	131 089 ..	IC, digital 4538B	1



SA-137 112-A

Figure 8-2. Circuit Card, Interface PC4

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

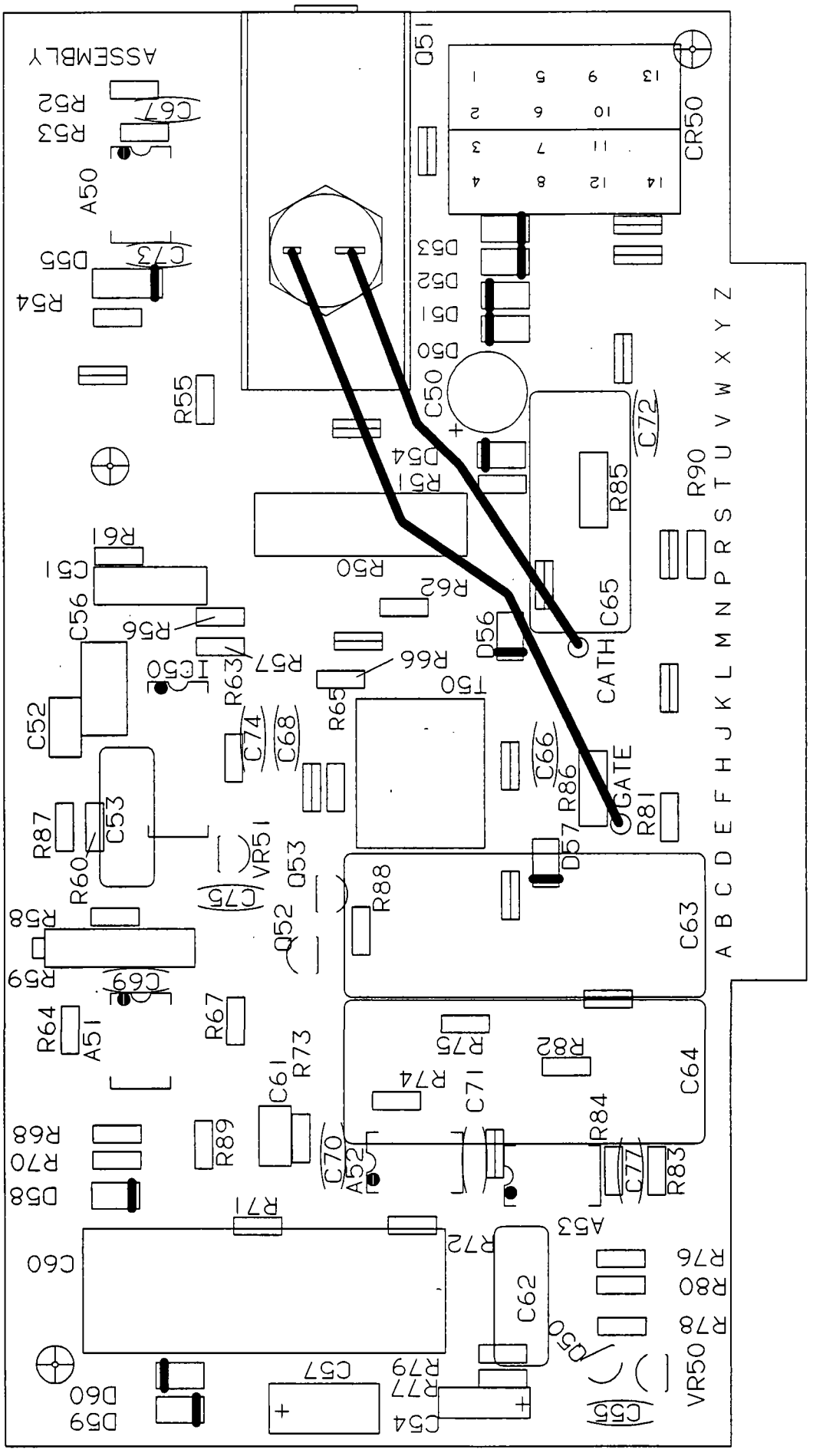


SB-140 778-A

Figure 8-3. Circuit Card, Dual Torch Adapter PC7

Dia. Mkgs.	Part No.	Description	Quantity
	1214050009288	**Figure 8-3. Panel, Dual Adapter**	
.....	1065360009288	BRACKET, mtg PC board	1
.... PC7	140 777	CIRCUIT CARD, dual torch adapter (consisting of)	1
.... C1-4	122 723	CAPACITOR, cer mono .1uf 50VDC	4
.... C5	031 677	CAPACITOR, tantlm 5.6uf 35VDC	1
.... C6	071 229	CAPACITOR, elctlt 470uf 16V	1
. CR1,2,5-8	093 192	RELAY, encl 24VDC DPDT	6
.... CR3	134 436	RELAY, encl 12VDC DPDT	1
.... CR4	039 346	RELAY, encl 24VDC DPDT	1
... D1-7,9	026 202	DIODE, rect 1A 400V SP	8
... D10-12	028 351	DIODE, sig .020A 75V SP	3
... J1-45	092 648	RESISTOR, ww fxd zero ohm	45
.. Q1,2,4-7	136 175	TRANSISTOR, IGBT module 18A 600V	6
.. Q3,8-10	037 200	TRANSISTOR, NPN 200MA 40V	4
... R3,8,9	039 331	RESISTOR, CF .25W 4.7K ohm	3
. R12,17,18	035 826	RESISTOR, CF .25W 6.8K ohm	3
R19-22,26-28	035 825	RESISTOR, CF .25W 1K ohm	7
... R23,24	035 823	RESISTOR, CF .25W 100 ohm	2
.... R25	039 335	RESISTOR, CF .25W 47K ohm	1
.... RC1	114 425	TERMINAL, hdr 16 pin	1
.... RC2	117 864	TERMINAL, hdr 14 pin	1
.... RC3	117 038	TERMINAL, hdr 2 pin	1
... RC4,6	140 775	TERMINAL, hdr 5 pin	2
... RC7,9	140 774	TERMINAL, hdr 3 pin	2
.... RC8	140 776	TERMINAL, hdr 7 pin	1
.... U1,2	008 970	IC, digital 4011	2
.... U3,4	094 347	IC, digital 4069	2
... PLG1	131 052	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
.....	113 746	TERMINAL, female 1skt 24-18 wire	16
... PLG2	131 056	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
.....	113 746	TERMINAL, female 1skt 24-18 wire	14
... PLG3	131 054	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
.....	113 746	TERMINAL, female 1skt 24-18 wire	2
.. PLG4,6	133 890	HOUSING, term plug nyl 5cont	2
.....	125 748	TERMINAL, contact box shaped leaf 22-18 wire	1
.. PLG7,9	128 336	HOUSING, term plug nyl 3cont	2
.....	125 748	TERMINAL, contact box shaped leaf 22-18 wire	3
... PLG68	133 889	HOUSING, term plug nyl 7cont	1
.....	125 748	TERMINAL, contact box shaped leaf 22-18 wire	7
.....	126 368	STAND-OFF SUPPORT, PC card No. 6scr	6
.....	141 667	CASE SECTION, front/bottom	1
.....	141 449	PANEL, side	1
.....	141 666	PANEL, rear	1
.....	139 465	COVER	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

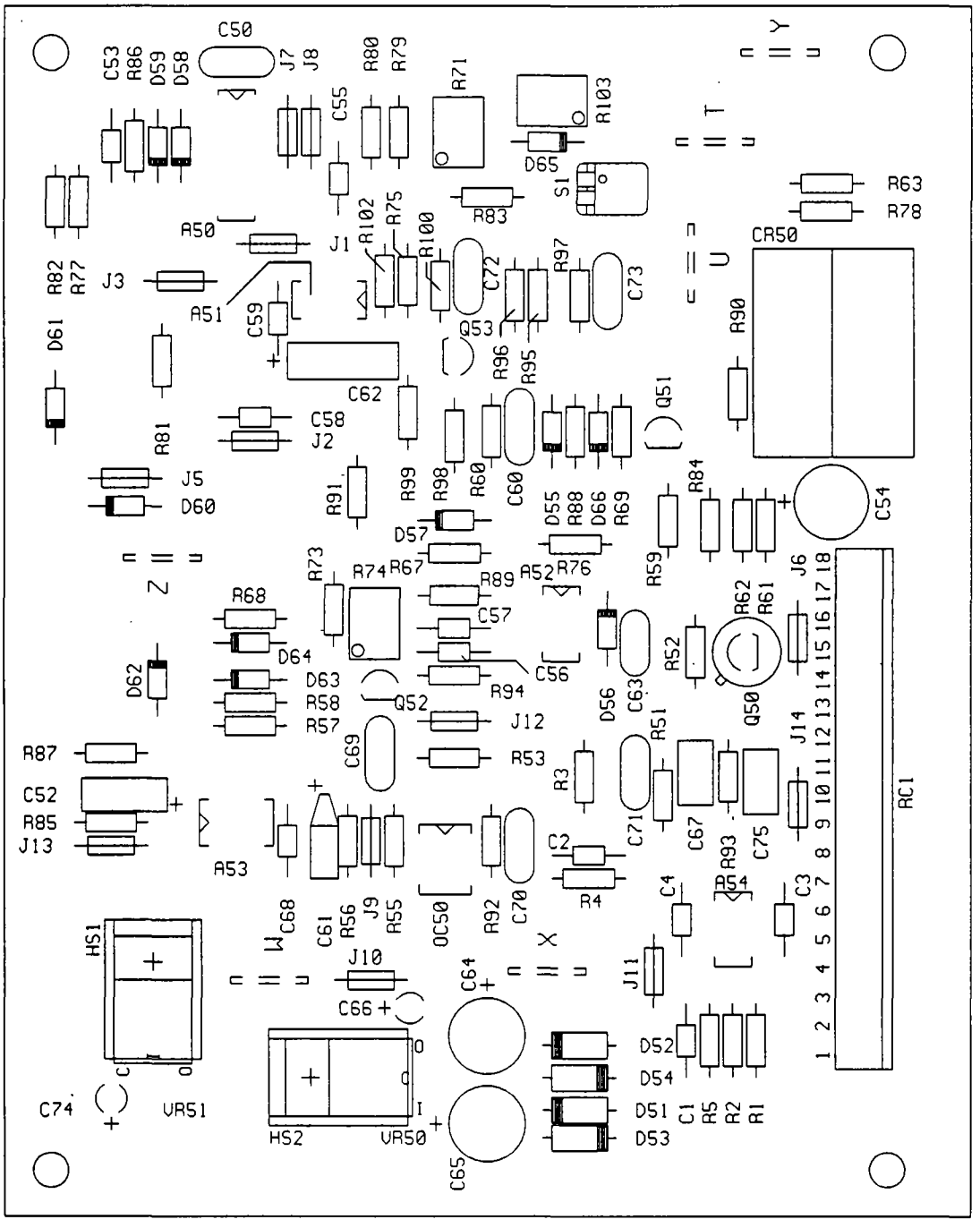


SC-093 380-E

Figure 8-4. Circuit Card, Motor Speed PC2

Dia. Mkgs.	Part No.	Description	Quantity
PC2	**071 642**	**Figure 8-4. Circuit Card, Motor Speed (Fig 8-1 Item 3)**	
A50-53	009 159	IC, linear 358	4
C50	039 482	CAPACITOR, elctlt 100uf 35VDC	1
C51	031 699	CAPACITOR, polye film .0022uf 200VDC	1
C52,61	073 739	CAPACITOR, cer mono .1uf 50VDC	2
C53,62	035 833	CAPACITOR, polye film .033uf 100VDC	2
C54	005 023	CAPACITOR, tantlm 2.2uf 20V	1
C55, 66-75,77	031 643	CAPACITOR, cer disc .01uf 500VDC	12
C56	073 549	CAPACITOR, polye film .015uf 200VDC	1
C57	007 742	CAPACITOR, elctlt 10uf 35V	1
C60	035 561	CAPACITOR, polye met film 4uf 200V	1
C63,64	044 602	CAPACITOR, polye film .47uf 400VDC	2
C65	031 721	CAPACITOR, polye film .22uf 200VDC	1
CR50	095 033	RELAY, encl 24VAC 4PDT	1
	091 861	SOCKET, relay 14skt	1
	079 844	SPRING, hold down relay	1
D50-54,56-60	026 202	DIODE, rect 1A 400V SP	10
D55	080 910	DIODE, zener 15V 5W	1
IC50	081 800	IC, interface 2907	1
Q50,53	037 200	TRANSISTOR, NPN 200MA 40V	2
Q51	037 824	THYRISTOR, SCR 7.4A 200V	1
Q52	039 355	TRANSISTOR, UJT 15MA 40V	1
R50	030 839	RESISTOR, WW fxd 5W 220 ohm	1
R51,54,55,57,67 68,74,75,82,89	035 827	RESISTOR, CF .25W 10K ohm	10
R52,56,61	052 138	RESISTOR, MF .25W 20K ohm	3
R53	039 332	RESISTOR, CF .25W 15K ohm	1
R58,62,65,66 71,72,76,90	035 884	RESISTOR, CF .25W 100K ohm	8
R59	030 007	POTENTIOMETER, cermet trmr 15/T .75W 50K ohm	1
R60,87,88	039 335	RESISTOR, CF .25W 47K ohm	3
R63,79	039 106	RESISTOR, CF .25W 470 ohm	2
R64	039 331	RESISTOR, CF .25W 4.7K ohm	1
R70	049 015	RESISTOR, CF .25W 10 meg ohm	1
R73,83	039 328	RESISTOR, CF .25W 1.5K ohm	2
R77	052 142	RESISTOR, MF .25W 121K ohm	1
R78	039 108	RESISTOR, CF .25W 82K ohm	1
R80	035 886	RESISTOR, CF .25W 22K ohm	1
R81,84	035 825	RESISTOR, CF .25W 1K ohm	2
R85	030 937	RESISTOR, C .5W 10 ohm	1
R86	030 090	RESISTOR, C .5W 47 ohm	1
	092 648	RESISTOR, WW fxd zero ohm	15
T50	085 399	TRANSFORMER, pulse	1
VR50	081 799	IC, linear 78L08	1
VR51	047 272	IC, linear 78L12	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

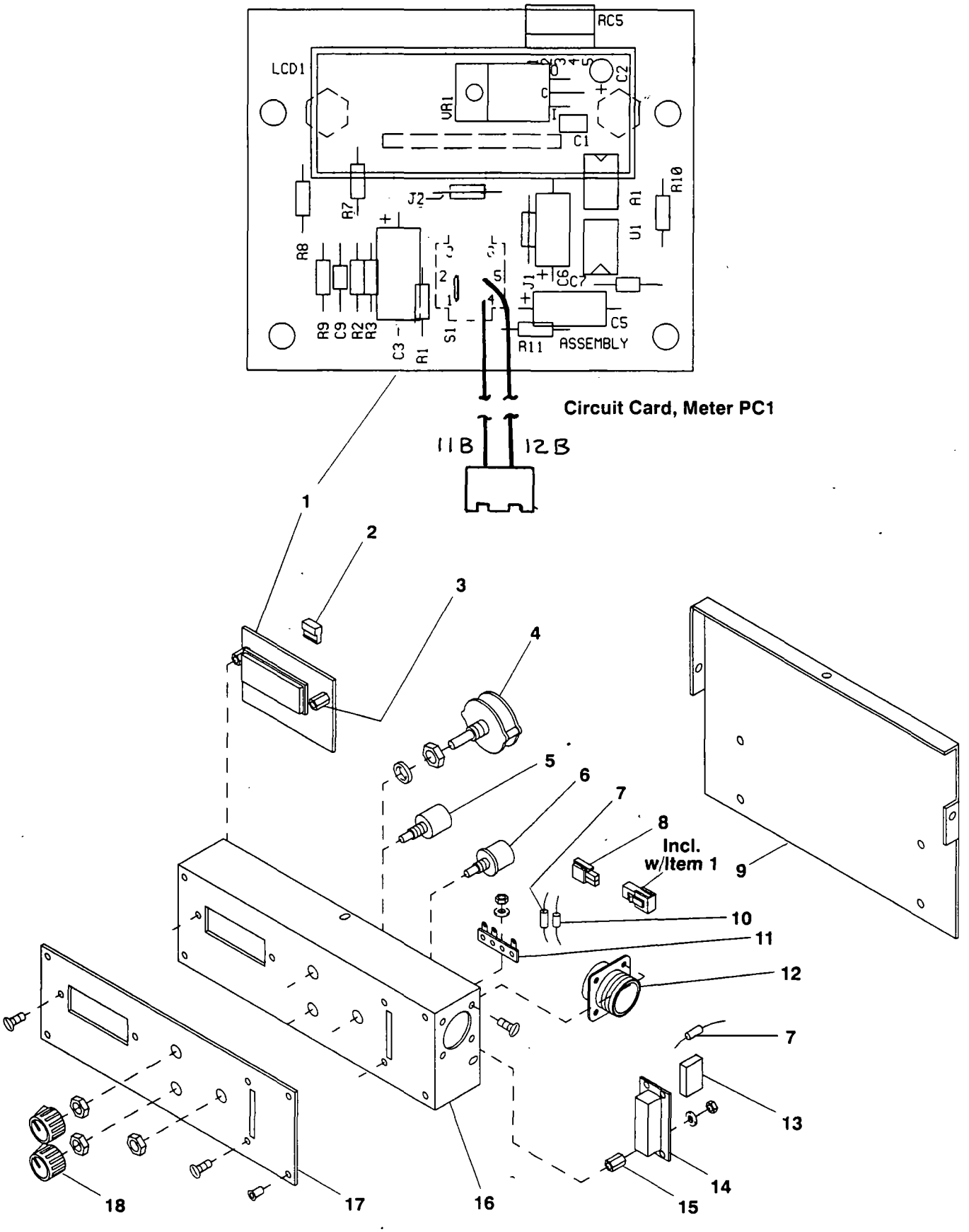


SB-135 520-B

Figure 8-5. Circuit Card, Voltage Control PC1

Dia. Mkgs.	Part No.	Description	Quantity
PC1	**137 695**	**Figure 8-5. Circuit Card, Voltage Control (Fig 8-1 Item 51)**	
A50	096 275	IC, linear 324	1
A51,52,54	114 176	IC, linear 353	3
A53	009 159	IC, linear 358	1
C1-4,53, 55-59,68	122 723	CAPACITOR, cer mono .1uf 50VDC	11
C50,60,69-73	000 340	CAPACITOR, cer disc .01uf 50VDC	7
C52	031 677	CAPACITOR, tantlm 5.6uf 35VDC	1
C54	000 861	CAPACITOR, elctlt 33uf 35V	1
C61	005 023	CAPACITOR, tantlm 2.2uf 20V	1
C62	009 577	CAPACITOR, tantlm 27uf 35V	1
C63	053 992	CAPACITOR, cer disc .001uf 1000VDC	1
C64,65	118 460	CAPACITOR, elctlt 330uf 50VDC	2
C66,74	000 348	CAPACITOR, tantlm .47uf 35V	2
C67,75	121 684	CAPACITOR, ploye met film .47uf 100V	2
CR50	093 558	RELAY, encl 120VAC 4PDT	1
	091 861	SOCKET, relay 14skt	1
	079 844	SPRING, hold down relay	1
D51-54	026 202	DIODE, rect 1A 400V SP	4
D55-66	028 351	DIODE, sig .020A 75V SP	12
J1-15	092 648	RESISTOR, WW fxd zero ohm	15
OC50	047 034	IC, interface 4N26	1
Q50	035 842	TRANSISTOR, PNP .6A 40V	1
Q51-53	037 200	TRANSISTOR, NPN 200MA 40V	3
R1,2	089 174	RESISTOR, MF .25W 100K ohm	2
R3	089 176	RESISTOR, MF .25W 20K ohm	1
R4,5,67,76	089 175	RESISTOR, MF .25W 10K ohm	4
R51,80,86,87	039 331	RESISTOR, CF .25W 4.7K ohm	4
R52,91	035 888	RESISTOR, CF .25W 2.2K ohm	2
R53,73	078 431	RESISTOR, C .25W 330 ohm	2
R55-57,85	035 827	RESISTOR, CF .25W 10K ohm	4
R58,61	039 336	RESISTOR, CF .25W 220K ohm	2
R59,60,95-97	035 826	RESISTOR, CF .25W 6.8K ohm	5
R62,68,82	035 825	RESISTOR, CF .25W 1K ohm	3
R63,78	097 110	RESISTOR, MF .25W 1K ohm	2
R69	108 437	RESISTOR, MF .25W 4.75K ohm	1
R71	000 038	POTENTIOMETER, cermet trmr 25/T .5W 2K ohm	1
R74,103	009 173	POTENTIOMETER, cermet trmr 20/T .5W 5K ohm	2
R75,89	052 137	RESISTOR, MF .25W 5.11K ohm	2
R77	039 333	RESISTOR, CF .25W 18K ohm	1
R79	039 330	RESISTOR, CF .25W 3.9K ohm	1
R81	035 886	RESISTOR, CF .25W 22K ohm	1
R83	084 205	RESISTOR, MF .25W 3.32K ohm	1
R84	000 885	RESISTOR, MF .25W 10K ohm	1
R88,92	081 833	RESISTOR, CF .25W 2.7 meg ohm	2
R90	035 885	RESISTOR, CF .25W 68K ohm	1
R93	091 799	RESISTOR, MF .25W 8.25K ohm	1
R94	035 823	RESISTOR, CF .25W 100 ohm	1
R98	039 329	RESISTOR, CF .25W 2.7K ohm	1
R99	108 433	RESISTOR, MF .25W 2.43K ohm	1
R100	117 134	RESISTOR, MF .25W 24.3K ohm	1
R102	121 714	RESISTOR, MF .25W 51.1K ohm	1
RC1	079 749	TERMINAL, header 18 pin	1
S1	092 367	SWITCH, DIP SPST 2posn	1
VR50	083 772	IC, linear 7815	1
VR51	046 932	IC, linear 7915	1

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.



Ref. A-134 394
SB-136 517

Figure 8-6. Display Pendent

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
		1339800009288	**Figure 8-6. Display Pendent**	
1	PC1	134 396	CIRCUIT CARD, meter (consisting of)	1
	A1	009 159	IC, linear 358	1
	C1	083 182	CAPACITOR, cer mono .1uf 50VDC	1
	C2	000 348	CAPACITOR, tantlm .47uf 35V	1
	C3	072 935	CAPACITOR, elctlt 33uf 35VDC	1
	C5,6	007 742	CAPACITOR, elctlt 10uf 35V	2
	C7,9	122 723	CAPACITOR, cer mono .1uf 50VDC	2
	J1,2	092 648	RESISTOR, WW fxd zero ohm	2
	LCD1	108 453	METER, digital 0 to 2 VDC	1
	R1	095 823	RESISTOR, MF .25W 44.8K ohm	1
	R2	095 822	RESISTOR, MF .25W 5K ohm	1
	R3,7-10	094 040	RESISTOR, MF .25W 1 meg ohm	5
	R11	097 110	RESISTOR, MF .25W 1K ohm	1
	RC5	121 085	TERMINAL, header 5 pin	1
	U1	110 325	IC, interface 7662	1
	VR1	071 248	IC, interface 78M05	1
		135 635	HOUSING PLUG & PINS, (consisting of)	1
		114 656	TERMINAL, male 1 pin 24-18 wire	2
		109 161	TERMINAL, header 13skt	1
2	PLG5	111 500	CONNECTOR, plug 5posn	1
3		073 356	STAND-OFF, No. 6-32 x .625 lg	2
4	S1	134 117	SWITCH, rotary	1
5	R3	603 856	POTENTIOMETER, WW sltd sft 10/T 2W 10K ohm	1
6	S2	113 333	SWITCH, PB MC NO SPST 1A 115VAC	1
7	R1,2	030 938	RESISTOR, C .5W 1.2K ohm	2
8	PLG6	131 054	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
		113 746	TERMINAL, female 1skt 24-18 wire	2
9		1340130009288	BRACKET, mtg control box	1
10	D1	026 202	DIODE, rect 1A 400V SP	1
11	1T	038 785	STRIP, terminal 3P	1
12	RC1	077 175	RECEPTACLE, 11 pin MS-3012A-20-33P	1
13	PLG4	134 859	HOUSING PLUG & SOCKETS, (consisting of)	1
		125 748	TERMINAL, contact box-shaped leaf 22-18 wire	6
14	PC2	139 646	CIRCUIT CARD, display	1
15		098 691	STAND-OFF, No. 6-32 x .500 lg	2
16		134 017	CASE SECTION, front/sides	1
17			NAMEPLATE, (order by model and serial number)	1
18		097 922	KNOB, pointer	2

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
		133 981	**Figure 8-7. WCR Box**	
1		+134 015	WRAPPER	1
2		131 515	LABEL, warning electric shock	1
3		007 501	WASHER, flat nylon .265 ID x .437 OD x .187thk	2
4	RS1	140 786	RELAY, current	1
5		010 494	BUSHING, snap-in nyl 1.375 ID x 1.750mtg hole	2
6		057 358	BUSHING, snap-in nyl 1.000 ID x 1.375mtg hole	2
7		134 014	CASE SECTION, bottom/sides	1
8	R1	074 051	RESISTOR, C .5W 100 ohm	1
9	1T	038 861	BLOCK, term 20A 3P	1
10		134 016	BRACKET, mtg	2
11		123 531	STRAIN RELIEF, cable flexible	1
12		134 241	CABLE, port No. 18 2/c (order by ft)	6ft
13		039 828	CLAMP, cable AN-3057-6	1
14	PLG1	047 544	PLUG, 4skt MS-3106A-14S-2SX	1

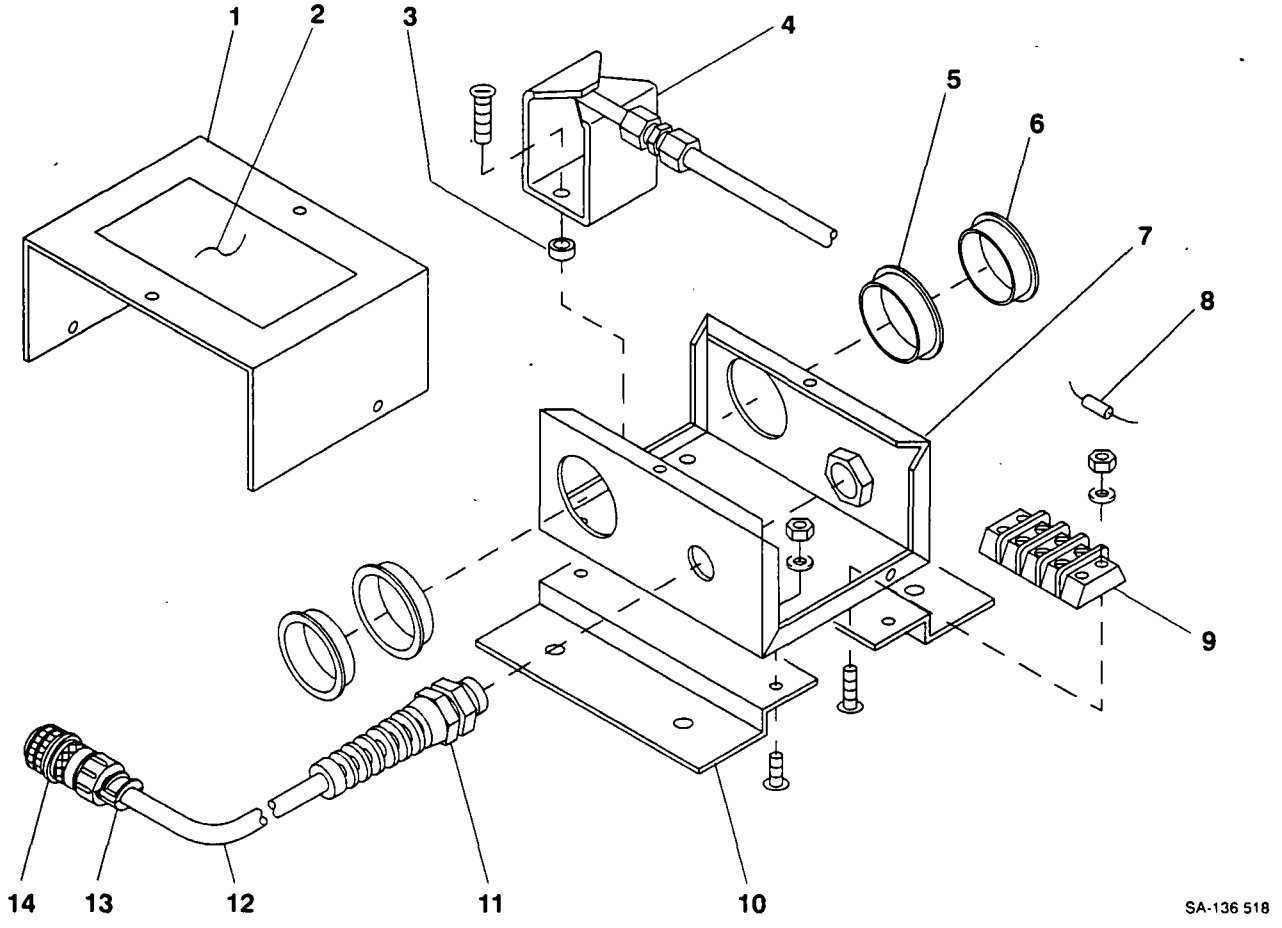


Figure 8-7. WCR Box

+When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
		1371140009288	**Figure 8-8. Control Box, Gas/Motor**	
1		134 327	LABEL, warning general precautionary	1
2		+079 682	WRAPPER	1
3		109 021	CASE SECTION, bottom/front/sides	1
4		115 104	CONNECTOR, clamp cable .500	1
5		010 494	BUSHING, snap-in nyl 1.375 x 1.750mtg hole	2
6		057 360	BLANK, snap-in nyl 1.375mtg hole	2
7		010 604	FITTING, hose brs bushing 1/4NPT x .625-18RH	2
8		602 934	FITTING, pipe coupling .250NPSC	1
9		079 573	FITTING, pipe-nipple L .250NPT x 6.000	1
10		079 574	BRACKET, mtg component	2
11	RC7	047 637	HOUSING RECEPTACLE & SOCKETS, (consisting of)	1
		079 534	. TERMINAL, female 1skt 18-14 wire	14
12	D1	026 202	DIODE, rect 1A 400V SP	1
13	4T	038 081	BLOCK, term 20A 4P	1
14	GS1	109 293	VALVE, 24VDC 2way 1/4 IPS port 1/8 orf	1
15	RC16	090 246	RECEPTACLE W/PINS, (consisting of)	1
		079 535	. TERMINAL, male 1 pin 18-14 wire	16

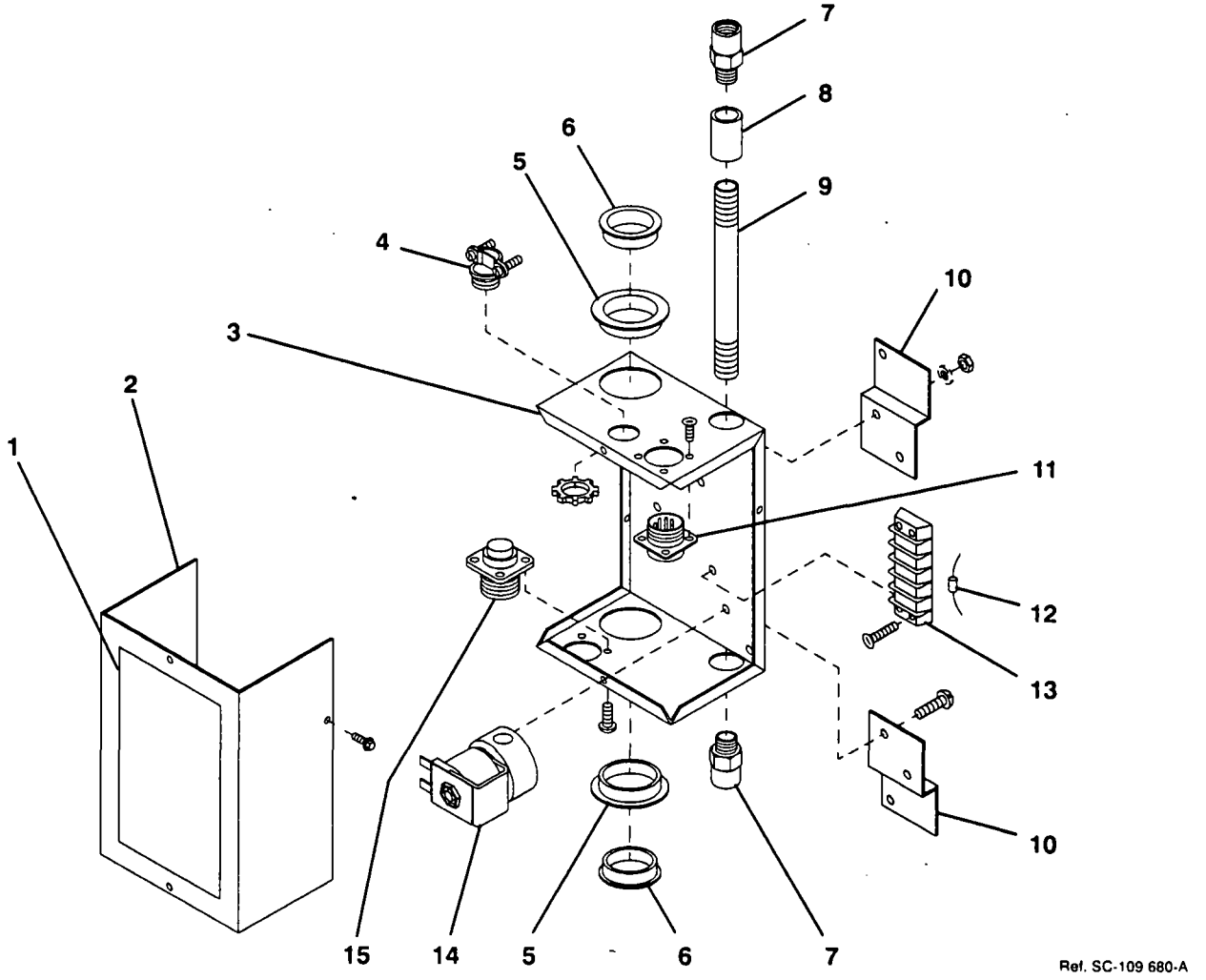
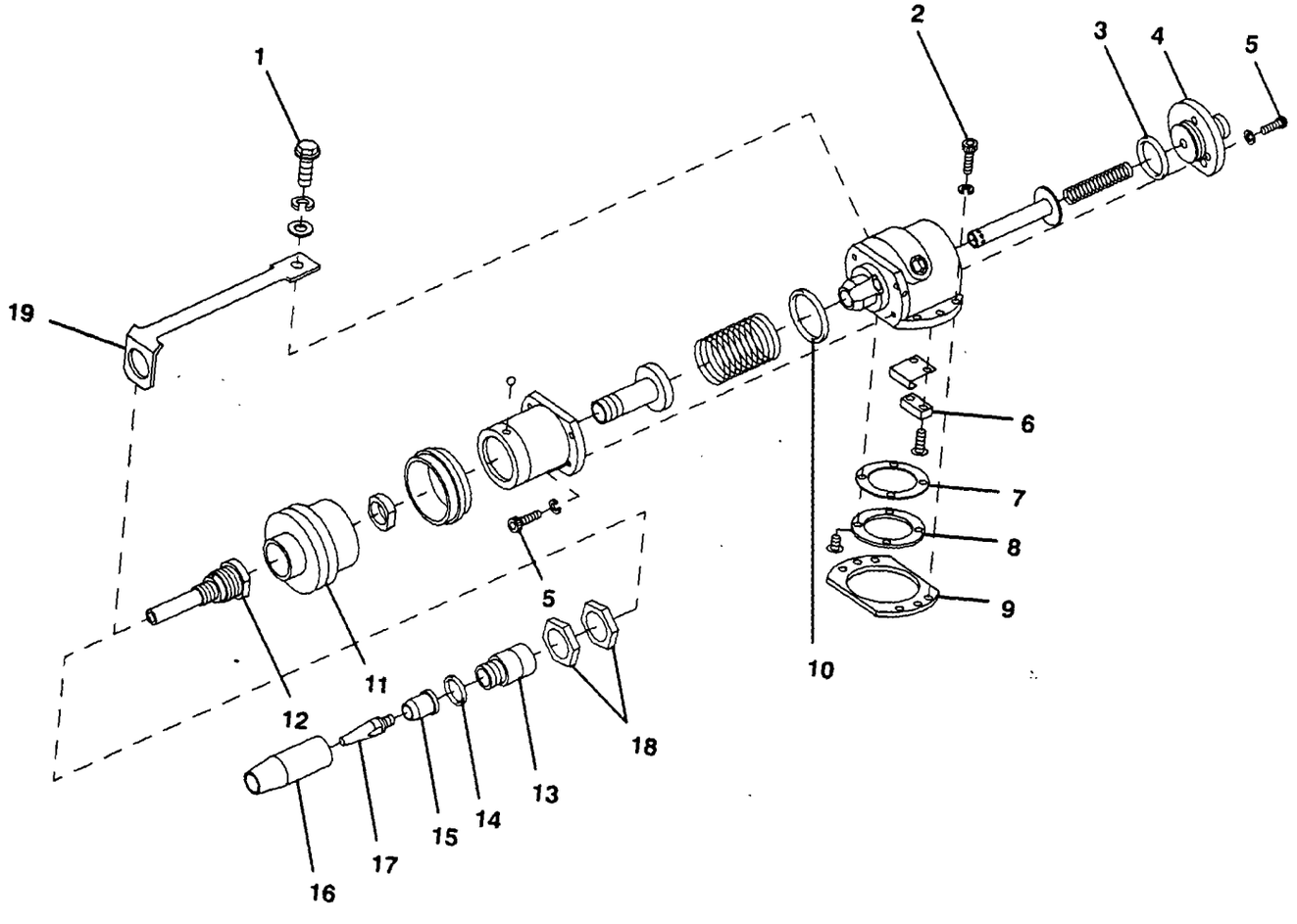


Figure 8-8. Control Box, Gas/Motor

+When ordering a component originally displaying a precautionary label, the label should also be ordered.
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

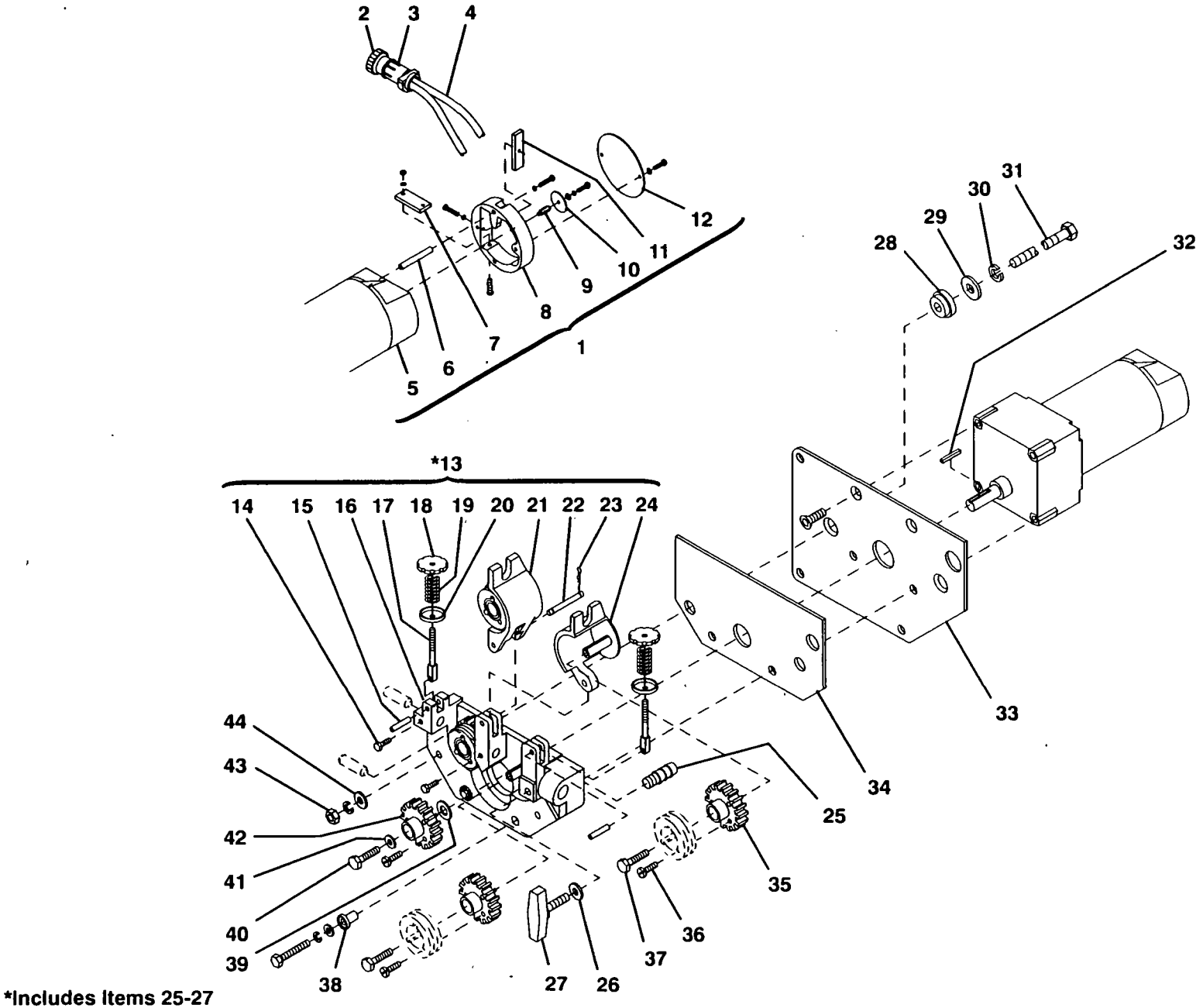


SB-114 229-A

Figure 8-9. MTX 3502 Air Cooled Gun

Item No.	Part No.	Description	Quantity
	113 883	**Figure 8-9. MTX 3502 Air Cooled Gun**	
1	115 527	SCREW, cap hexhd 8MM x 1.25 x 15MM	1
2	115 526	SCREW, cap skt hd M5 x .8 x 14mm	6
3	108 780	0-RING, (S-25)	1
4	114 249	ADAPTER, brs	1
5	115 524	SCREW, cap skt hd 4MM x .7 x 12MM	6
6	108 772	MICROSWITCH	1
7	108 773	PACKING	1
8	108 774	SWITCH COVER	1
9	108 775	SHIM	1
10	108 779	O-RING, (S-32)	1
11	108 766	BOOT, rbr	1
12	108 768	ADAPTER, tip	1
13	108 776	INSULATION, bush	1
14	108 778	O-RING, (P12)	1
15	108 777	INSULATOR, cer	1
16	108 784	NOZZLE, (No. 8)	1
16	♦110 854	NOZZLE, (No. 7 short)	1
16	♦108 793	NOZZLE, (No. 8 long)	1
16	♦108 785	NOZZLE, (No. 10)	1
16	♦112 471	NOZZLE, (No. 6 short)	1
16	♦112 470	NOZZLE, (No. 6 long)	1
16	♦112 469	NOZZLE, (No. 7 long)	1
16	♦112 468	NOZZLE, (fine)	1
17	108 789	CONTACT TIP, (Q0.9)	1
17	♦108 788	CONTACT TIP, (Q0.8)	1
17	♦108 786	CONTACT TIP, (Q1.2)	1
17	♦108 790	CONTACT TIP, (Q1.6)	1
17	♦129 886	CONTACT TIP, .023 wire	1
18	108 767	NUT	2
19	114 251	POWER SUPPLY WIRE, (consisting of)	1
	108 770	PROTECTION TUBE	1

♦OPTIONAL



*Includes Items 25-27

SD-070 798-E

Figure 8-10. Motor/Drive Assembly

Item No.	Dia. Mkgs.	Part No.	Description	Quantity
		109 366	**Figure 8-10. Motor/Drive Assembly**	
1		+046 967	MOTOR ASSEMBLY, (consisting of)	1
2		047 636	HOUSING PLUG & PINS, (consisting of)	1
		079 535	TERMINAL, male 1 pin 18-14 wire	14
3		079 739	CLAMP, cable	1
4		081 630	CORD, motor 17 in	1
5		+080 802	MOTOR, gear 1/8hp 115V 200RPM (consisting of)	1
		080 283	COVER, brush	2
		080 282	SPRING, brush	2
		*080 281	BRUSH	2
6		049 033	SPACER, housing tach	2
7		110 738	CIRCUIT CARD, tach (consisting of)	1
	C50	073 739	CAPACITOR, cer mono .1uf 50VDC	1
	D50	094 934	DIODE, zener 5.1V 400MW	1
	OC50	094 268	IC, interface 973N51	1
	R50	052 140	RESISTOR, C .5W 330 ohm	1
	R51	039 328	RESISTOR, CF .25W 1.5K ohm	1
		094 464	CORD, tach 15 in	1
8		049 029	HOUSING, tach feedback	1
9		049 031	SHAFT, extension armature	1
10		110 733	OPTICAL ENCODER DISC	1
11		049 032	CLAMP, strain relief	1
12		049 030	COVER, housing tach feedback	1
13		046 779	WIRE DRIVE, (consisting of)	1
14		601 925	SCREW, cap stl hexhd .250-20 x .500	2
15		010 224	PIN, spring CS .187 x 1.000	2
16		046 621	HOUSING, adapter gun/feeder	1
17		085 242	FASTENER, pinned	2
18		085 243	KNOB, adj tension	2
19		010 231	SPRING, cprsn .770 OD x .105 wire x 1.225pld	2
20		085 244	WASHER, cupped stl .328 ID x .812 OD x .125 lip	2
21		079 669	LEVER, mtg pressure gear	1
22		079 634	PIN, hinge	1
23		604 741	PIN, cotter hair .042 x .937	1
24		046 619	LEVER, mtg pressure gear	1
25		079 633	FITTING, hose barbed nipple 3/16tbg	1
26		604 538	WASHER, flat stl SAE .312	1
27		079 772	KNOB	1
28		075 150	WASHER, shldr nyl 1.000 OD x .375	2
29		010 910	WASHER, flat stl SAE .375	2
30		602 213	WASHER, lock stl split .375	4
31		079 624	SCREW, cap stl hexhd slflkg .375-16 x 2.250	2
32		092 865	KEY, .122 x .122 x .750	1
33		070 396	STRIP, mtg motor	1
34		070 397	INSULATION, motor	1
35		053 842	GEAR, spur insul w/bearing	4
36		079 626	SCREW, mach stl filh 10-32 x .875	15
37		605 518	SCREW, cap stl hexhd .250-20 x 1.250	4
38		072 010	WASHER, shldr nyl .437 OD x .316 ID x .187 lip	2
39		079 625	WASHER, spring stl .500 shakeproof	2
40		000 418	SCREW, cap stl hexhd slflkg .250-20 x .500	1
41		602 241	WASHER, flat stl SAE .250	1
42		093 664	GEAR, spur	1
43		601 872	NUT, stl hex full fnsh .375-16	2
44		602 243	WASHER, flat stl std .375	2
		++1214070009288	BRACKET, mtg dual feeder	1
		++127 815	INSULATOR	1
		++046 781	KIT, drive roll & guide (consisting of)	1
		053 700	ROLL, drive V groove .035 wire	4
		056 192	GUIDE, wire inlet	1
		056 206	GUIDE, wire intermediate	1

*Recommended Spare Parts.
+When ordering a component originally displaying a precautionary label, the label should also be ordered.
++Items not included with Motor/Drive Assembly
BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.

Item No.	Part No.	Description	Quantity
		Figure 8-11. Inlet Cable System	
1	058 427	. . RING, retaining spool	1
2	♦108 008	. . REEL, wire (consisting of)	1
3	124 904	. . . NUT, spanner spool support	1
4	124 905	. . . RETAINER, spool support	1
5	124 900	. . . SUPPORT, reel spool	1
6	085 980	. . NUT, stl hex full fnsh .625-11	1
7	605 941	. . WASHER, flat stl .640 ID x 1.000 OD x 14ga thk	2
8	010 233	. . SPRING, cprsn .970 OD x .120 wire x 1.250pld	1
9	057 971	. . WASHER, flat stl keyed 1.500 dia x .125thk	2
10	010 191	. . WASHER, fbr .656 ID x 1.500 OD x .125thk	4
11	058 628	. . WASHER, brake stl	4
12	058 428	. . HUB, spool	1
13	072 475	. . SUPPORT, spindle	1
	044 937	. . BASE, feeder	1
	072 298	. . PLATE, mtg support spindle	1

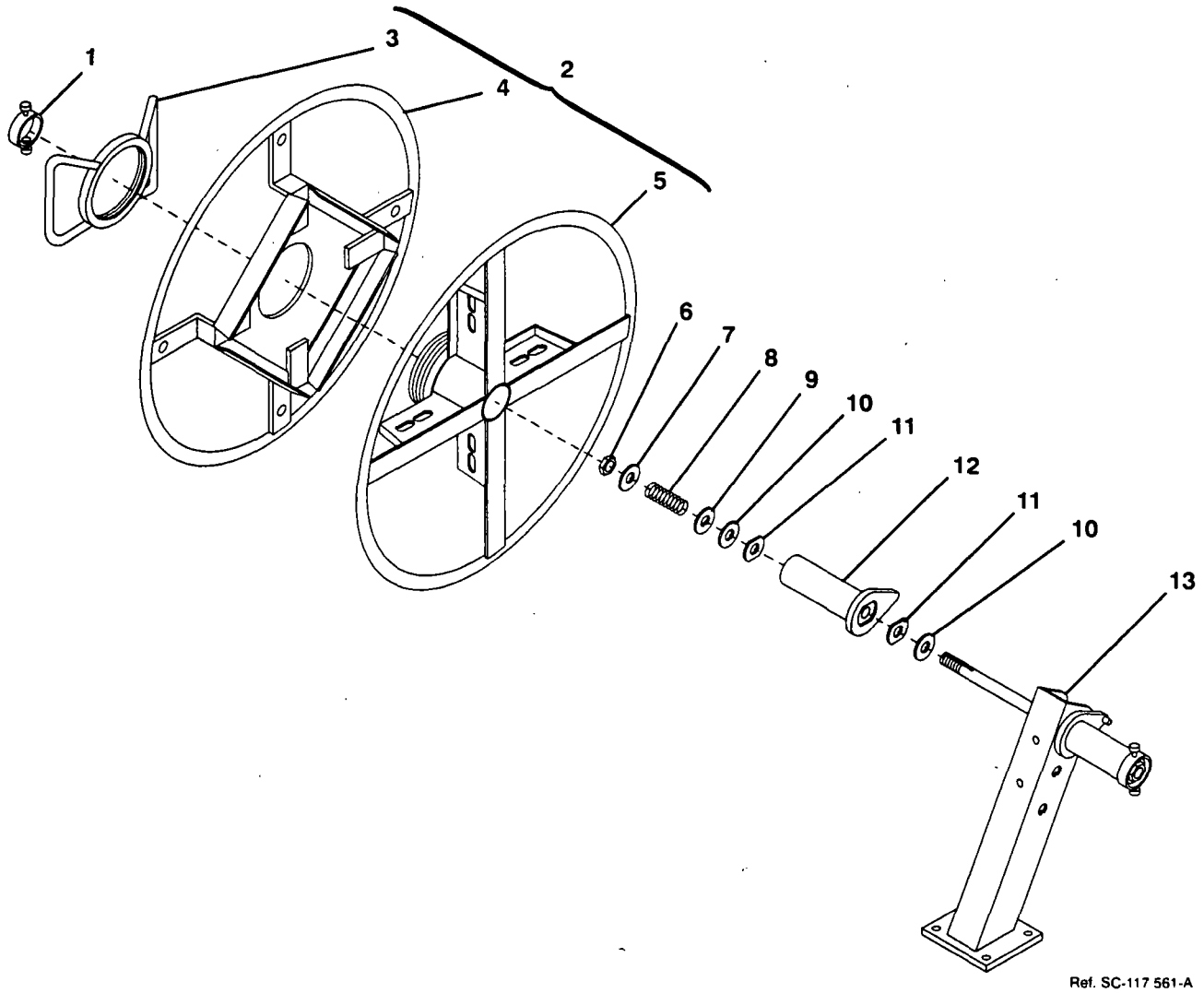


Figure 8-11. Inlet Cable System

♦OPTIONAL

BE SURE TO PROVIDE MODEL AND SERIAL NUMBER WHEN ORDERING REPLACEMENT PARTS.